

Third Edition

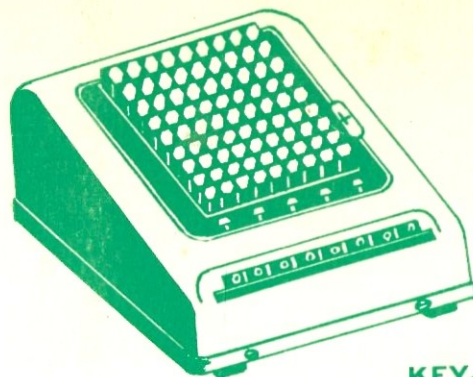
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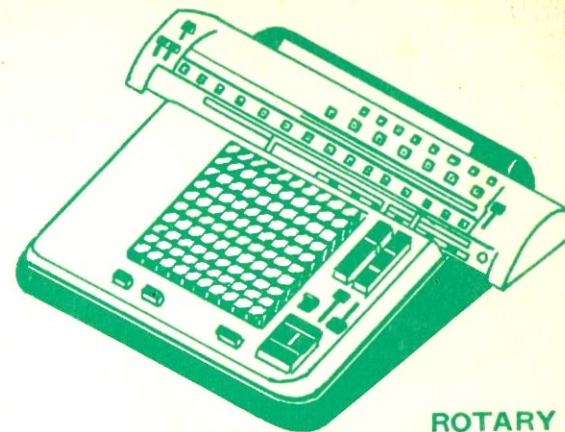
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KEY-DRIVEN



ROTARY



FULL-KEYBOARD



TEN-KEY

Office Machines Course

ADDING AND CALCULATING MACHINES

OFFICE MACHINES COURSE

Third Edition

for the

Full=Keyboard Adding Listing Machine

Ten=Key Adding Listing Machine

Rotary Calculator

Key=Driven Calculator

By

Peter L. Agnew

and

Nicholas J. Cornelia



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FOREWORD

This book presents well-organized instructional material for use with the four types of adding and calculating machines — the full-keyboard adding listing machine, the ten-key adding listing machine, the rotary calculator, and the key-driven calculator. It is designed to provide a reasonable skill in the use of each of these four types of machines.

The fifty jobs include ten on the full-keyboard adding listing machine, ten on the ten-key adding listing machine, fifteen on the rotary calculator, and fifteen on the key-driven calculator. Each job is planned so that the average student may complete it in a class period. The average student, through the use of all the practice material, should be able to develop a fair degree of efficiency in basic operation of each of the four types of adding and calculating machines.

If not enough time can be devoted to the course for the student to use all the material in this workbook, the best use will be made of it by having the students complete some, rather than all, of the work of each job. When time must be saved, the simplest as well as most satisfactory procedure to follow is to have the students complete every other problem in each job, rather than every problem in every job.

In planning and preparing this instructional material, certain basic qualities have been maintained:

1. The instructional materials are well within the range of the ability of the student who may use this book.
2. With the use of this instructional material, the student should attain a reasonable degree of efficiency in the basic operation of the four types of adding and calculating machines and do so in a reasonable length of time.
3. The teaching materials are carefully planned, easy to follow, convenient for practice, and simple to check.
4. The jobs of this book are arranged in carefully planned sequences, going from the simple to the somewhat more complex operations.
5. The materials in this course may be used on any of the various adding and calculating machines that are on the market. Special instructions are included to cover the more common differences that exist among these makes of machines and the various models thereof.
6. The format of the book is designed so that it may be used easily at the machine. Students may remove the parts of the pages that contain problems and leave in the book for future reference the parts that contain instructional material.
7. The book is planned so that it is as self-instructional as possible. All instructions for new work are presented in an easy-to-follow, step-by-step plan.
8. Each timed drill contains problems which test the student's mastery of the new procedures presented in the job as well as provide the basis for the development of a reasonable speed. Small figures at the right of each problem indicate the stroke or digital count, usually in convenient multiples of ten, and provide the basis for intensive speed and control drills.
9. The last job sheet of each of the four sections of this book contains a comprehensive review. These job sheets — numbers 10, 20, 35 and 50 — may be used as timed tests or as reviews, at the option of the teacher.
10. Each job in this book is planned so that it introduces something new and also affords ample review of everything that has been taught in prior jobs.

The authors would like to take this opportunity to express appreciation to the various machine manufacturers and their representatives who have been so cooperative.

P. L. A.

N. J. C.

FULL-KEYBOARD ADDING LISTING MACHINE



ACQUIRING THE MULTIPLE-KEY DEPRESSION TECHNIQUE FOR ADDITION OF NUMBERS

Overview

Office machines that are classified as **full-keyboard** adding listing machines can be readily identified because they have:

1. Keyboards with from 7 to 10 rows or **banks** of keys each of which begins with 1 at the end of the machine nearest the operator and ascends to 9 at the opposite end. (See the illustration on this page.)
2. A narrow roll of paper, called **tape**, on which are printed the numbers that are added.
3. Total keys, subtotal keys, non-add keys, repeat keys, subtraction keys or bars, add bars, and correction keys.
4. On hand-operated models, handles instead of electrically operated plus (+), minus (-), and multiplication (X) bars.

Adding machines that are classified as full-keyboard adding listing machines include the R. C. Allen, Barrett, Burroughs, Remington (formerly Clary), Monroe, National, Smith-Corona, and Victor. These machines are used primarily to add columns of figures, printing them on tapes that can be filed away for future reference or auditing. Some firms also use the full-keyboard adding listing machines for subtraction and multiplication of numbers.

The arrangement of the keys on full-keyboard adding listing machines makes possible the use of the multiple-key depression technique which enables



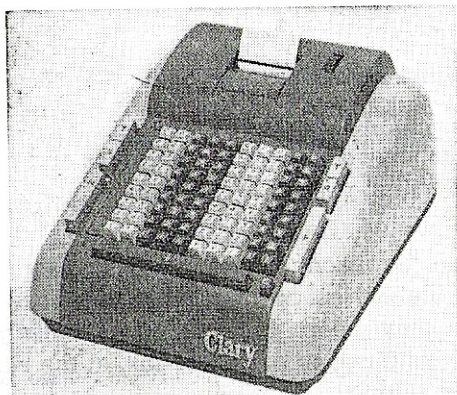
Proper Position for the Machine, Textbook, and Operator

an operator to depress the keys for a number and add-list it in one or two motions. To do this, an operator uses his thumb, first, and second fingers to depress the keys for a number and his fourth finger to add-list it. A fully trained operator depresses two to five keys in a single motion. Proficiency in the use of the multiple-key depression technique enables an operator to develop an adding speed of from 100 to 125 depressions per minute. The main objective of this course is to develop speed and accuracy in the use of the multiple-key depression technique as it applies to adding, subtracting, and multiplying on a full-keyboard adding listing machine.

General Instructions

Proficiency in the use of any office machine is dependent upon the formation of acceptable habits of operation. To insure maximum efficiency in the operation of a full-keyboard adding listing machine, you should cultivate the following habits:

1. Maintain a neat work area.
 - a. Clear your desk or table of books and papers that do not pertain to the course.
 - b. Place the machine on the right of your desk or table and this book to the left of the machine. You may keep your personal belongings, such as purse or extra pencils, at the right of the machine.
 - c. Position the machine and book to give you ease of operation and reading. Study the arrangement of materials in the picture at the left.
 - d. Sit erect, relax, and put both feet flat on the floor.
2. Clear the machine before starting a job.
 - a. Begin and end every problem by taking a total. This clears out any numbers that may have been left in the machine from previous use. An asterisk (*) or "T" will appear on the tape to indicate that the machine has been cleared.
 - b. To clear a hand-operated machine, depress the total key and pull down the operating handle. On some machines, you may have to operate the handle before you can depress the total key.
 - c. To clear an electrically driven machine, depress the total key. On some machines, you may also have to depress the plus (+) or motor bar.



The Clary Full-Keyboard Adding Machine

3. After you have completed all problems:

- a. Arrange the tapes in numerical order.
- b. Remove from this book the page containing the problems for the job.
- c. Attach the tapes to the job sheet at the upper left corner with a staple or clip.
- d. Write your name and the other information called for in the space provided in the upper right side of the first page of the job.
- e. Give the completed job to the instructor.



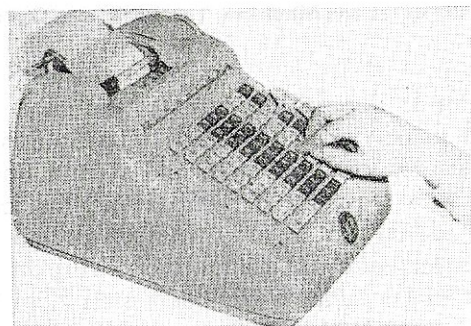
The R. C. Allen Full-Keyboard Adding Machine

JOB No. 1 (Cont'd.)

Procedure

Use the following multiple-key depression technique to add-list the numbers that appear in Problems 1 - 12:

1. The items in Problem 1 contain two-digit numbers that are close together on the keyboard. To add-list the first number, .44:
 - a. Use the first or index finger to depress 4 in column two, the second column from the right of the keyboard.
 - b. Use the second finger to depress 4 in column one, the first column at the right of the keyboard.



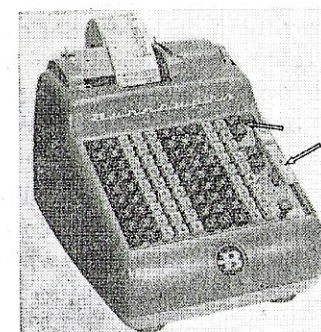
Depressing Keys for .44

- c. Keep the fourth or little finger on the motor bar so that it can be used to depress the motor bar at the same time that the keys for .44 are depressed.
- d. Whenever convenient, depress the keys for the number and the motor bar together in one hand motion. On the National Live Keyboard machine, pushing the keys all the way down add-lists the item without the use of a motor bar. On hand-operated machines, the handle is operated after the keys for the number have been depressed.



The Victor Full-Keyboard Adding Machine

- e. Work down the column until you have added all the numbers. Try to increase your speed with each number you add.
- f. After you have add-listed all the items in Problem 1, take a total by following the same procedure you used to clear the machine at the beginning of the problem.
- g. Write the total in the space provided under the problem. Immediately do the problem a second time. Try to improve your speed.
- h. If the second answer is different from the first, write it directly below the first answer and do the problem again. Write the answer that proves to be correct in the Answers column at the right.
- i. Tear off the tape for each problem and write the number of the problem on it.



The Total Key and Motor Bar

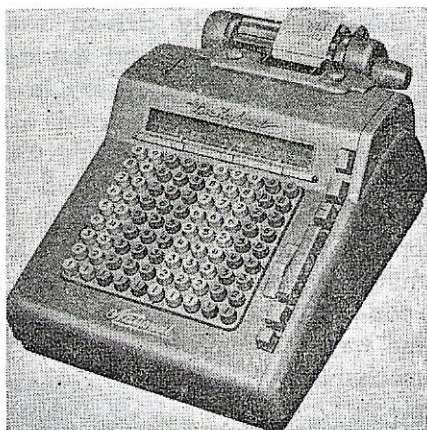
JOB No. 1 (Cont'd.)

2. The even-numbered problems contain three-digit numbers that are close together on the keyboard. To add-list three-digit numbers that contain the same figures (like 4.44), use the first, second, and third fingers to depress the three numbers with one hand motion. To add-list three-digit numbers in which **only the first two figures are the same**, follow these steps:
- a. Use the thumb to depress the two keys for the figures that are the same. The rows of keys are close enough to each other to permit you to depress two adjacent keys by centering your thumb between the rows.
 - b. Use the first or second finger to depress the remaining figure in column one.
 - c. Use the fourth finger to depress the motor bar. All three depressions should be made simultaneously when it is convenient to do so.
 - d. On the **hand-operated models**, operate the handle separately.
 - e. On most **electrically driven machines**, the keys for a number and the motor bar can be conveniently depressed in a single operation by keeping the tip or side of the little finger on the motor bar. On the Remington machine, numbers can also be add-listed by using the bottom bar instead of the side motor bar. On the National Live Keyboard machine, depressing the keys for the number also add-lists it because each key, if depressed all the way, automatically operates the add-list mechanism.

JOB No. 1 (Cont'd.)

3. If incorrect keys are depressed and the error is discovered before the number has been printed, the error can be corrected by:
 - a. Depressing the error or correction key, or, if the keys are in the same column, depressing the correct key, which will automatically release the incorrect key.
 - b. If the machine has an error key for each column, depressing the key for the column in which the error was made will eliminate the incorrect figure and permit the machine to print a zero in that column.
4. Use the procedures described above to add-list the items in Problems 13 - 24.
 - a. Read the numbers at a glance. Avoid the need for a second look.
 - b. In reading numbers and depressing keys, turn the eyes, not the head.
5. When you have completed all the problems, follow the general instructions for numbering tapes and attaching them to the job sheet, filling in the information called for at the top right of the first page of the job.
6. Give the completed job to your instructor.

The National Live Keyboard Adding Machine



(4)



MULTIPLE-KEY DEPRESSION TECHNIQUE FOR ADDITION — ASCENDING REACHES

Overview

In this job, you will practice depressing keys for numbers having two and three digits that are **not** close together on the keyboard. You will also learn to use the **non-add key** to print a number on the tape without adding that number in the machine.

Procedure

1. Clear the machine. An asterisk (*) or a (T) must appear at the beginning and end of the tape for each problem.
2. Number each problem. To do this, depress the key or keys for the problem number, depress the **non-add key**, and operate the motor bar, if necessary, or the handle. Space once after the problem number by operating the handle or depressing the motor bar.
3. Use the following multiple-key depression technique to add-list the items in each problem:
 - a. In Problem 1, enter 11 in the machine in one motion, using the first and second fingers to depress two 1's and the fourth finger to operate the motor bar simultaneously.
 - b. To enter 14 in the machine, use one motion, depressing the 1 with the thumb and the 4 with the second finger while the fourth finger operates the motor bar simultaneously.
 - c. In Problem 7, enter 6.69 in the machine in one motion, using the tip or side of the thumb to depress the two 6's and the second finger to depress the 9. The fourth finger is kept on the motor bar, which is depressed at the same time whenever it is convenient to do so.

(5)

JOB No. 2 (Cont'd.)

- d. In completing Problems 1 - 12, use all three fingering techniques. Avoid awkward positions by depressing the motor bar separately whenever necessary. On the National Live Keyboard, pushing the keys all the way down automatically add-lists the number, hence the fourth finger is not used.
4. Complete the Timed Drill. To do this, add each problem once and record the answer in the first space. Before you do the drill again:
- Set an interval timer or use the classroom clock to time yourself for five minutes.
 - Do as many problems as you can in the five-minute period. If you finish all problems and have time left over, start again. Place a check mark beside the answer to indicate that you finished the problem a second time.
 - Look for the nearest small figures (digital count) above the last number you added. Count the number of digits you added beyond that point, and add them to the digital count.
 - Divide the sum by 5, and record your GROSS DIGITS PER MINUTE (GDPM) in the space provided at the top of the page where the job begins.
 - If time permits, do the Timed Drill again. Record the answers in the second space. Record only your best GDPM.
 - If you do not have an interval timer, follow instruction 6b on page 30.
5. Give the completed job to your instructor. Follow the same procedure used for Job No. 1 in handing in your work.

(6)



MULTIPLE-KEY DEPRESSION TECHNIQUE FOR ADDITION — DESCENDING REACHES

Overview

In Job Nos. 1 and 2, you learned how to use the thumb, first, second, and fourth fingers to depress keys for numbers having ascending reaches of 1 to 8 steps. In this job, you will practice depressing keys for numbers having descending reaches of 1 to 8 steps.

Procedure

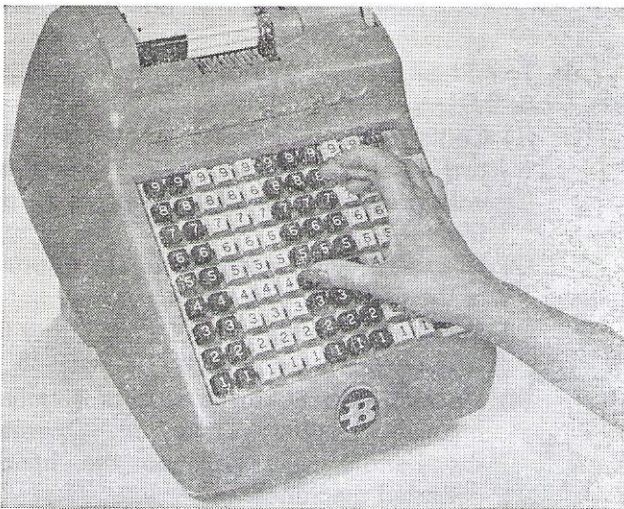
- Clear the machine.
- Number each problem.
- Use the following **multiple-key depression technique** to add-list the items in each problem:
 - To add-list a two-digit number such as 21 or 91:
 - Use the first or second finger to depress the higher figure, 2 or 9, in column two.
 - Use the thumb to depress the low figure, 1, in column one.
 - Use the tip or side of the fourth finger to operate the motor bar.
 - Depress with all three fingers simultaneously whenever convenient. Operate the handle separately on the hand-operated machines.
 - To add-list a three-digit number such as 2.21 or 9.91:
 - Center the first or second finger over the two adjoining figures of the number in columns three and two to depress 22 or 99.
 - Use the thumb to depress the low figure of the number, 1, in column one.
 - Use the tip or side of the fourth finger to depress the motor bar.
 - Depress with all three fingers simultaneously whenever convenient. Operate the handle separately on the hand-operated machines.

(7)

JOB No. 3 (Cont'd.)

4. Complete Problems 1 - 12.
 - a. Add-list each problem twice, and record the correct answer in the column at the right of the page.
 - b. Attach the tapes to the left side of the job sheet.
5. Complete the Timed Drill. Follow the procedure you used in Job No. 2, and record your GDPM in the space provided at the beginning of the job.
6. Give the completed job to your instructor. Follow the procedure outlined in Job No. 1.

Using the Thumb to Depress the Low Numbers



(8)



MULTIPLE-KEY DEPRESSION TECHNIQUE FOR ADDITION—USE OF THUMB AND AUTOMATIC ZEROS

Overview

In this job, you will learn to depress the keys for three-digit numbers in one operation by using the thumb for the low figure in the number and the first and second fingers for the high figures. The fourth finger will be kept on the motor bar so that it can be operated at the same time the other keys are depressed. You will also learn that to add-list a zero in any column, you merely skip that column. The machine will automatically print a zero there.

Procedure

1. Clear the machine, and number each problem.
2. Use the following multiple-key depression technique to add-list the items in each problem:
 - a. A three-digit number with a low figure at the left such as 1.23:
 - (1) Use the thumb to depress 1 in column three.
 - (2) Use the first and second fingers to depress 2 and 3 in columns two and one.
 - b. A three-digit number with a low figure at the right such as 7.86:
 - (1) Turn the wrist slightly to the left to bring the thumb in position to depress 6 in column one.
 - (2) Use the first and second fingers to depress 7 and 8 in columns three and two.
 - c. A three-digit number with a low figure in the middle such as 2.13:
 - (1) Turn the wrist slightly to the left to bring the thumb in position to depress 1 in

(9)

JOB No. 4 (Cont'd.)

column two.

- (2) Use first and second fingers to depress 2 and 3 in columns three and one.
 - d. Three-digit numbers containing zeros:
 - (1) Do not depress any key in the column in which the zero appears.
 - (2) Use the thumb and first or second finger to depress the other two keys.
 - e. In all of the above fingering techniques, simultaneously depress the motor bar with the fourth finger whenever convenient. On the National Live Keyboard machine, omit this step.
3. Complete Problems 1-12.
 - a. Follow the procedures outlined above.
 - b. Add-list each problem twice, and record the correct answer in the column at the right of the page.
 - c. Try to increase your speed the second time you add-list each problem.
 - d. Attach the tapes to the left side of the job sheet.
 4. Complete the Timed Drill. Follow the procedure outlined in Job. No. 2, and record your GDPM at the top of the first page of this job.
 5. Give the completed job to your instructor.

(10)



THREE-DIGIT ADDITION FURTHER DEVELOPED, REPEAT ADDITION, AND MULTIPLICATION

Overview

In this job, you will use two separate hand motions to add-list three-digit numbers that contain figures with a spread between them that is too great for easy simultaneous depression. You will also learn how to use the repeat (R) or multiplication (X) key to add-list numbers that are the same and to multiply.

Procedure

1. Clear the machine, and number each problem.
2. Use the following multiple-key depression technique:
 - a. To add-list a number with figure combinations that cannot be depressed simultaneously, such as 4.21 (Problems 1-3):
 - (1) Use the first finger to depress 4 in column three.
 - (2) With a separate hand motion, use the first finger to depress 2 in column two and the thumb to depress 1 in column one.
 - (3) Whenever convenient, use the fourth finger to depress the motor bar simultaneously.
 - b. To add-list a series of numbers that are exactly the same (Problems 4-6):
 - (1) Set up the number to be added on the keyboard.
 - (2) Depress or latch down the repeat (R) key and operate the motor bar, or depress and **hold down** the live multiplication (X) key (on the Monroe, hold down the plus (+) bar) until the number prints as many times as it appears consecutively.
 - (3) Depress the error (E) or correction (C) **key to release the keys for the number**

(11)

JOB No. 5. (Cont'd.)

added, if not already released, and repeat the procedure for the remaining series of like numbers.

- c. To multiply by one-digit multipliers, use the same procedure you followed to add-list a series of like numbers. In all multiplication problems, record the answer only once. Make a check mark (✓) next to the answer the second time.
 - d. To multiply by two- or three-digit multipliers, follow the procedure listed below for multiplying 487×48 (Problem 10):
 - (1) Set up 487 on the keyboard.
 - (2) Depress or latch down the repeat or multiplication key and operate the motor bar; **or** hold down the live (X) key 8 times.
 - (3) Depress (E) or (C) to release the keys for 487, if necessary.
 - (4) Set up 487 on the keyboard one column to the left of the columns used the first time. (This would be the same as depressing the keys for 4870.)
 - (5) Depress or latch down the (R) or (X) key where necessary, and operate the motor bar; **or** hold down the live (X) key 4 times.
 - (6) Depress the (E) or (C) and take a total.
 - e. To multiply by three- or more-digit multipliers, begin at the extreme right of the multiplier and move one column to the left for each digit in the multiplier.
 - f. Ignore the decimal point that is automatically printed except for multipliers with decimals.
3. Complete all the problems in this job. Attach the tapes to the left side of the job sheet.
 4. Complete the Timed Drill.
 5. Give the completed job to your instructor.

(12)



**FOUR-DIGIT ADDITION
AND SUBTRACTION**

6-10

Overview

This job requires the use of two separate hand motions in order to add-list four-digit numbers. The two figures at the left of the decimal point are depressed simultaneously in one hand motion, while the two figures to the right of the decimal point and the motor bar are depressed with a second hand motion.

This job also introduces the use of the subtraction key to deduct numbers.

Procedure

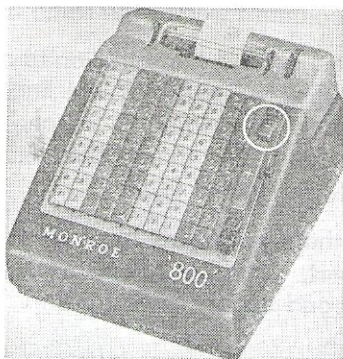
1. Clear the machine, and number each problem.
2. Use the following multiple-key depression technique:
 - a. To add-list the four-digit numbers that appear in Problems 1-5, follow these steps for adding 67.45:
 - (1) Use the first finger to depress 6 in column four and the second finger to depress 7 in column three at the same time.
 - (2) Use a second hand motion to depress 4 in column two with the first finger and 5 in column one with the second finger, depressing the motor bar simultaneously with the fourth finger.
 - (3) If the figures are more than three keys apart, use the thumb and the first or second finger, as you did in the previous job.

(13)

JOB No. 6 (Cont'd.)

- (4) On the National Live Keyboard machine, use the same fingering techniques, but be sure to depress the first two figures only far enough to hold them down without printing the numbers. The last two, of course, are depressed all the way so that all four figures print.
- b. To subtract 11.56 from 36.43 in Problem 6:
- (1) Add-list the minuend (36.43) using the fingering techniques described above.
 - (2) Depress the keys for the subtrahend (11.56) and then depress the minus (—) bar.
 - (3) On the hand-operated models, depress the subtract key or move the lever to the subtract position, and operate the handle. On some hand-operated models, you must return the lever to the plus (+) position and operate the handle.
 - (4) Take a total as usual.
 - (5) Turn up the tape a few spaces after each problem, and tear it off after every five problems.
3. Complete the Timed Drill, and give the completed job to your instructor.

The Minus (—) Key



(14)



ADDITION OF FIVE- AND SIX-DIGIT NUMBERS AND THE SUBTOTAL KEY

Overview

1-5

This job introduces the addition of five- and six-digit numbers. You will learn to use three hand motions to add-list these large numbers.

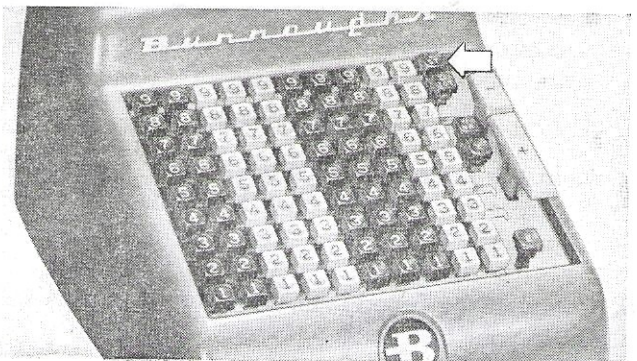
This job also introduces the use of the subtotal key. The key is marked "S," "ST," or "Subtotal" and is usually located at the upper right of the keyboard. It is used to total a series of numbers which have been add-listed without clearing the amount out of the machine.

In this job, you will learn how to use the subtraction key to eliminate from the total items that have been incorrectly entered on the tape.

Procedure

1. Clear the machine, and number the problems.
2. Use the following multiple-key depression technique:
 - a. To add-list 178.25 in Problem 1:
 - (1) Use the first finger to depress 1 in column five.
 - (2) Use a second hand motion to depress 7 and 8 in columns four and three, respectively.

The Subtotal Key



(15)



11-15

Overview

This job introduces the procedure to be followed to obtain a credit balance. Because there are business situations in which the items to be subtracted exceed those that are to be added, some totals result in minus quantities. These are commonly called **credit balances**. You will learn how to use the subtraction key to list the credit items marked with a minus (-) sign and (on some machines) how to use the credit balance release key, to get a credit balance.

Procedure

1. Clear the machine, and number the problems.
2. Use the multiple-key depression techniques you learned in the previous jobs to add-list or to subtract the items in Problems 1-10. Problem 1 is used as a sample:
 - a. Add-list 788.37.
 - b. Depress the keys for 960.27, operate the subtraction bar, key, or lever, and, where necessary, the motor bar or handle.
 - c. Take a total. On some machines, you must first depress the credit balance release key, located under the total key, before you can get a credit balance total. Because the subtracted number exceeds the added number, the answer is a credit balance.

- (3) Use a third hand motion to depress 2 and 5 in columns two and one, respectively.
- (4) Keep the fourth finger on the motor bar so that it can be depressed at the same time that the last group of keys is depressed. On the National Live Keyboard machine, depress the first two groups of keys only far enough to hold without printing, but be sure to depress the last group all the way.
- b. To add-list six-digit numbers, follow the same procedure outlined for five-digit numbers. All three hand motions involve **two** figures.
3. Use the following procedure to obtain a subtotal:
 - a. Depress the subtotal key.
 - b. Operate the motor bar, if necessary, or the handle.
4. To add-list items marked "Er.":
 - a. Items marked "Er." are numbers for which the wrong figures were depressed and **printed** on the tape.
 - b. Add-list these numbers as they appear in the problem.
 - c. Depress the same keys a second time, and depress the subtraction key before operating the motor bar or handle.
 - d. Add-list the number correctly.
 - e. In the future, use this method for correcting errors in numbers that have already been printed.
5. Complete the Timed Drill, and give the completed job to your instructor.



Overview

In this job, you will use the fingering techniques you learned in the previous jobs to work out practical problems connected with the office work done in a sales department.

Procedure

- d. Some machines will label credit balances "Cr" or show a minus (-) sign. If your machine has this feature, just record the answer in the space provided as 171.90 Cr.
- e. The answer shown by machines without a credit balance feature will be 999,828.10. The preceding nines indicate that the answer is a credit balance. Do **not** record this answer. Depress the keys for 999,828.10 on the keyboard and the subtraction key. Because you are subtracting from zero, the machine changes the complement of the credit balance to a positive credit balance answer.
- f. Take a total. The tape will show a total of 171.90. **You must record this as a credit balance — 171.90 Cr.** Without the "Cr," your answer will be incorrect.
3. In doing Problems 11-15, subtract items marked with a minus (-) sign and add all others.
 - a. If the numbers added exceed those subtracted, the total will be listed and marked as usual.
 - b. If the numbers subtracted exceed those added, the answer will be marked "Cr" or (-) on machines with a credit balance feature.
- c. **On machines without a credit balance feature**, a series of 9's will indicate that the answer is a credit balance. To get the true answer, follow the instructions listed under "e" above.
4. If a zero occurs at the end of a multiplier, as in 350, move one column to the left and multiply as usual. If a zero occurs in the middle, as in 505, move two columns to the left.
5. Complete the Timed Drill, and give the completed job to your instructor.

(18)

1. Subtract column (1) from column (2) to determine the amount of increase or decrease.
2. Place a plus (+) after the difference if the sales for this year were larger than for last year. Use a minus (-) if last year's sales exceeded this year's.
3. The first two answers are listed. Do the rest, and write the figures in column (3).
4. Subtract the items in column (4) from the items in column (5) to determine the amount of increase or decrease, and record the answers in column (6).
5. Total columns (1), (2), and (3). Be sure to subtract the items in column (3) that are marked (-) and to add those marked (+).
6. To prove the accuracy of your work, subtract the total of column (1) from the total of column (2). The answer should equal the total of column (3).
7. Total columns (4), (5), and (6) as you did the first three columns.
8. Prove the accuracy of the work by subtracting the total of column (4) from that of column (5). The difference should be the total of column (6).

(19)

JOB No. 9 (Cont'd.)

9. Complete the Timed Drill as follows:

- a. Add-list columns (1) and (2).
 - b. Subtract the departmental sales listed in column (1) from those listed in column (2).
 - c. Place a plus (+) after the differences when column (2) exceeds column (1). Use a minus (-) when column (1) exceeds column (2).
 - d. Total column (3), being careful to subtract the items marked (-) and to add those marked (+).
 - e. To prove the accuracy of your work, subtract the total of column (1) from that of column (2). It should equal the total of column (3).
 - f. Total column (4).
 - g. Subtract column (4) from column (2), and record the difference as a minus (-) or plus (+) in column (5).
 - h. Total column (5), adding pluses and subtracting minuses. The total of column (5) should equal the difference between the totals of columns (4) and (2).
 - i. Follow the usual procedures to complete Problems 2-13, and record your GDPM in the space provided at the top of page 19.
10. Attach the tapes to the left side of the job sheet.
11. Give the completed job to your instructor.

(20)



REVIEW

1-20

This job requires the application of all the operating principles presented in Job Nos. 1 through 9.

Procedure

1. Clear the machine, and number each problem.
2. Record the answer directly below each problem and in the Answers column at the right.
3. In the spaces provided, record the time the job was started, the time it was completed, the number of minutes required to complete the job, and the GROSS DIGITS PER MINUTE.
4. To compute the GDPM, first, if you did not complete the test, locate the last number you worked on during the timed review. Then locate the nearest small figures (digital count) above the number you used last. Count the digits you used beyond this point and add the number to the digital count. If you finished the test, use the last digital count figure. Divide the total by the number of minutes it took to do as much of the review as you were able to do in the testing period. You may use the reverse side of this page to do your figuring.
5. Write your name and the other information required in the spaces provided.
6. Arrange the tapes in numerical order, and attach them to the upper left corner of the job sheet.
7. Give the completed job to your instructor.

(Page 22 not required)

(21)



TOUCH ADDITION

Overview

Office machines that are classified as **ten-key adding listing machines** or **printing calculators** can be readily identified because they have:

1. A keyboard that consists of three banks, each of which has three keys.
2. A zero bar or keys which are located either at the bottom of or to the left of the keyboard.
3. A keyboard arrangement that enables an operator to use the center bank of keys (figures 4, 5, and 6) as home keys and reach up for the keys for figures 7, 8, 9 and reach down for the keys for figures 1, 2, and 3.
4. A narrow roll of paper called tape on which are printed the figures in the arithmetical problem that is being worked.
5. Total keys, subtotal keys, non-add keys, repeat keys or multiplication bars, subtraction keys or bars, back-spacers, digit indicators, and correction keys. Hand-operated models have handles instead of electrically operated plus (+), minus (-), or multiplication (×) bars.
6. In addition to the above features, printing calculators also have constant lock levers, division keys, stop keys, decimal keys, horizontal and vertical decimal indicators, and extended multiplication and division keys.

Adding listing machines or calculators that are classified as ten-key listing machines or printing calculators include: the R. C. Allen, the Barrett,

TEN-KEY ADDING LISTING MACHINE

the Burroughs, the Clary, the Comptograph, the Friden, the Monroe, the Odhner, the Olivetti, the Remington Rand group, the Underwood group, and the Victor. While these machines are used in business offices primarily to add columns of figures, they are being used increasingly to multiply, subtract, and divide.

The compact arrangement of the keys makes it possible to operate these machines by touch. This gives the operator all the advantages that go with touch typewriting — greater speed, a higher degree of accuracy, and less physical fatigue. Proficiency in the use of the touch method enables an operator to develop a speed of over 200 strokes per minute. The aim of this course is to develop speed and accuracy in the touch method of operating these machines as it applies to adding, multiplying, subtracting, and dividing.

General Instructions

1. Clear your desk or table of books and papers that do not pertain to the course.
2. Place the machine to the right of your desk or table, at a slight right angle, and this book at the left. You may keep your personal belongings, such as purse or extra pencils, at the right of the machine.
3. Position the machine and book to give you ease of operation and reading.
4. Sit erect, relax, and put both feet flat on the floor.

5. Place the first, second, and third fingers on the middle bank of keys — the keys for 4, 5, and 6.
6. Now move these fingers up to the top bank of keys — the keys for 7, 8, and 9.
7. Bring your fingers back to the middle bank. Notice that the home keys, 4, 5, and 6, are deeper than those of the upper bank.
8. Reach down to the lower bank of keys — the keys for 1, 2, and 3. Notice that these are not so deep as the home keys.
9. Put the thumb on the zero bar and the first, second, and third fingers on the middle bank of keys. This is the home-key position from which you reach out to all the keys on the keyboard.
10. Practice reaching up to 7 and down to 1 from the home key 4. Your fingers should be curved slightly, and you should guide your first finger to the center of the keys for 7, 4, and 1.
11. With your second finger, practice reaching up to 8 from the home key 5 and down to 2.
12. Similarly, practice the third-finger reaches from home key 6 up to 9 and down to 3.
13. Practice until you can reach for the figures 1 to 9 without looking at your fingers.
14. Practice depressing the zero bar or keys.



Clary Ten-Key Adding Machine



Monroe Ten-Key Adding Machine



Friden Ten-Key Adding Machine

15. Strike the keys firmly in the center and release them quickly as though they were red-hot. You can strike only **one** key at a time; therefore, be sure to release quickly so that the next key can be depressed without any waste of time.

16. If you happen to depress the wrong key and discover your error before pulling the handle or depressing the motor bar, use the error key, bar, or lever to eliminate the whole number from the machine. The error or correction keys are found at the left of the keyboard or underneath the keyboard. The lever on the Remington Rand machines is drawn all the way to the right; the lever on the Monroe machines is pushed forward. The lever on the Victor machines is drawn downward.



Underwood Printing Calculator



Victor Printing Calculator



Olivetti Electrosumma Ten-Key Adding Machine

JOB No. 11 (Cont'd.)

You should be familiar with the information on the introductory pages of this job before you begin the problems.

Procedure

1. Clear the machine.

- a. Depress the correction key or bar located at the left of the keyboard, or move the correction lever **up** on the Monroe, to the **right** on the Remington Rand, and **down** on the Victor. This will eliminate any numbers that may have been left in the machine. Correction keys are labelled "C," "E," or "Correction." The Olivetti Tetractys' correction key is unmarked. A "clear" symbol must appear at the beginning of every problem because it indicates that the machine was properly cleared and that only the items listed were added.
- b. If your machine has a multiplication (X) key or a repeat (R) key that latches down, be sure to release it by moving the key backward before attempting to clear the machine.
- c. Take a total.
 - (1) On hand-operated machines: pull the handle twice on Remington Rand machines; on other hand-operated machines, pull the handle down twice but depress the total key with the right thumb before releasing the handle the second time.
 - (2) On electrically operated machines, depress the total key (T), (*), (NO+TOTAL), or (TOTAL). On some machines, the total key must be depressed twice in order to get the "clear" symbol. Move total

lever **up** on the Victor machine; on the Olivetti Tetractys, depress the black and the green total keys marked with a star located in the second column to the right of the keyboard.

- (3) On the Remington Rand, depress the motor bar twice. On the Victor, depress the motor bar once.

2. Use the touch method you practiced above to complete the problems in this job. Keep your eyes on the figures of the problem **not on the keyboard**. You must find the keys **only by touch**. In listing 45.60, the first item in Problem 1, you should:

- Use the first or index finger of the right hand to depress 4. Use a firm, quick stroke, and release the key as though it were red-hot.
- Use the second or middle finger to depress 5, and be sure to release the key quickly.
- Use the third or ring finger to depress 6, and release it quickly.
- Use the thumb to depress the zero bar, and release it as quickly as you released 4, 5, and 6.
- Use the fourth or little finger to operate the plus (+) or motor bar. On the Olivetti Tetractys, depress the black plus (+) key or the thumb-operated auxiliary add bar located below the keyboard. On the hand-operated machines, pull down the handle.
- Work your way down the problem depressing all keys by the touch method.
- Depress the keys for each figure in the same order, left to right, that you follow to write numbers in longhand. On the Olivetti

Tetractys, depress the double zero (00) key for numbers containing two adjacent zeros, the triple zero (000) key for numbers containing three adjacent zeros.

- h. Take a total. Follow the instructions under 1 (c) above.

i. Write the answer directly below the problem in the space provided, and immediately do the problem a second time. If the second answer is the same as the first, write it in the proper space in the Answers column. If the second answer is different from the first, write it directly below the first answer and do the problem again. Write the answer that proves to be correct in the Answers column at the right.

3. Problems 7-12 introduce the keys 7, 8, and 9. The same touch method should be used to depress these keys as the 4, 5, and 6.

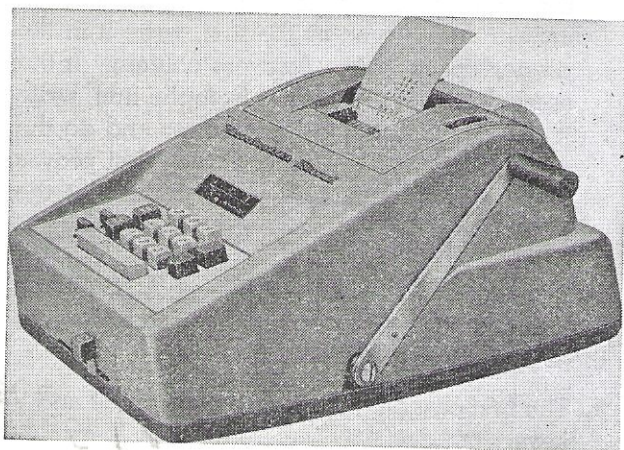
- The first or index finger depresses the 4 and 7 keys.
- The second or middle finger depresses the 5 and 8 keys.
- The third or ring finger depresses the 6 and 9 keys.

4. Problems 13-24 present the keys for 1, 2, and 3. The touch method for the proper depression of these keys is:

- The first or index finger depresses the 4, 7, and 1 keys.
- The second or middle finger depresses the 5, 8, and 2 keys.
- The third or ring finger depresses the 6, 9, and 3 keys.

JOB No. 11 (Cont'd.)

5. When a tape becomes as long as this page, tear it off and write the number (or numbers) of the problem (or problems) on it.
6. Arrange the tapes in numerical order and attach them to the left side of this job sheet.
7. Give the completed job to your instructor.



Hand-Operated Ten-Key Adding Machine



Remington Rand Fully Automatic Printing Calculator



TOUCH ADDITION AND THE NON-ADD KEY

Overview

The problems in this job contain one-, two-, and three-digit as well as four-digit numbers.

The keys for the numbers are depressed one at a time from left to right. In depressing the keys for a number such as .06, it is **not** necessary to depress the zero.

In this job, you will also learn to use the non-add key to print a number on the tape without adding it.

Procedure

1. Clear the machine. An asterisk (*), (T), or (◇) must appear at the beginning and the end of the tape for each problem.
2. Number each problem.
 - a. Depress keys for the number.
 - b. Depress the non-add key (#), (NON-ADD), (PRINT ONLY), (N), or (<).
 - c. Depress the motor bar, if necessary, or pull the handle.
 - d. Operate the motor bar or handle to leave a space after the number.
3. Use the touch method presented in Job No. 11 to add-list the items in Problems 1-6.
4. Non-add items followed by "N" in Problems 7-12 are entered as follows:
 - a. Depress the keys for the number.
 - b. Depress the non-add key.
 - c. Depress the motor bar, if necessary, or operate the handle.

JOB No. 12 (Cont'd.)

- d. Add-list the other items as usual.
5. Complete Problems 1-12.
 - a. Do each problem twice.
 - b. Record the answers in the spaces provided below each problem and at the right.
 - c. Attach the tapes to the left side of this job sheet.
6. Complete the Timed Drill.
 - a. If an interval timer is available, follow instructions 4 (a) to 4(e) on page 6.
 - b. If an interval timer is not available:
 - (1) Record in the margin of this page the time at which you started.
 - (2) Do each problem once.
 - (3) Above the beginning time, record the time at which you completed the drill.
 - (4) Subtract to determine the number of minutes it took to complete the test. Drop fractional parts of a minute.
 - (5) Divide the last small figure, 896, by the number of minutes it took you to complete the test. This will give you your GSPM.
 - (6) If time permits, do the Timed Drill again.
7. Record your best speed in the space provided at the top of the page.
8. Attach the tapes to the left side of the job sheet.
9. Give the completed job to your instructor.

(30)



REPEAT ADDITION AND MULTIPLICATION

Overview

In this job, you will learn to use the repeat (R) or multiplication (X) key to add-list numbers that are exactly the same and to multiply.

Procedure

1. Clear the machine.
2. Use the non-add key to number each problem.
3. Add-list the items in Problem 1:
 - a. Depress, by the touch method, the keys for 474.80.
 - b. Latch down the repeat key marked "X." On the Olivetti Tetractys, move the repeat lever to the left. On the Victor, hold the repeat lever down.
 - c. Depress the motor bar five times, or hold down the "live" multiplication key for five motor revolutions — the number of times the same number is repeated in the problem.
 - d. Operate the correction key or lever to clear the number out of the machine.
 - e. Follow the same procedure for all numbers that are repeated. Be sure to clear the number out of the machine before you depress the keys for the next number or take a total.
4. Do Problem 2 in the same manner.
5. Follow the steps listed below for Problem 3.
 - a. Depress the keys for the multiplicand, 456.
 - b. Latch down the repeat key and depress the motor bar five times, the figure at the extreme right of the multiplier. If your multiplication key is "live," hold it down until the machine registers five times.
 - c. Depress the zero bar to move 456 one column to the left.

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Remington Rand

1. To work Problem 3, first clear the machine.
2. Depress, by touch, the keys for 456.
3. Depress the positioning key (♦) located under the 3 key. This key is depressed once for every figure in the multiplier less one.
4. Multiply from **left to right** by depressing the automatic multiplication keys (located below the keyboard) for 3 and then 5.
5. If your machine has a multiplication lever at the left of the keyboard, push it **away** from you and hold it while the machine operates three times and quickly release the lever. Then push the lever forward again and hold it while the machine operates five times and quickly release the lever.
6. The total, 15960, will print automatically.

Victor

1. Push control lever up; "X" will appear at left of keyboard.
 2. Depress, by touch, keys for 456 and motor bar.
 3. Depress, by touch, keys for 35 and motor bar.
 4. The total, 15960, will print automatically.
- d. Depress the motor bar or hold down the "live" multiplication key three times.
- e. Operate the clear key or lever and take a total as usual. The product should be 15960.
- f. If the multiplier contains more than two digits, depress the zero bar once and multiply as above for each additional digit.
6. Complete Problems 4-10 following the procedure outlined above.
 7. Complete the Timed Drill using the procedure outlined in Job No. 12.
 8. Arrange the tapes in numerical order, and attach them to the left side of this job sheet.
 9. Give the completed job to your instructor.

(32)



TOUCH ADDITION INVOLVING ADDENDS OF VARIED NUMBER OF DIGITS

Overview

The problems in this job involve the addition and multiplication of items that contain from 1 to 6 digits. The basic procedures followed in solving these problems are similar to those used in the previous jobs. The aim of this job is to review the work covered to date and to further develop the touch system so as to increase your operating speed and improve your accuracy.

Procedure

1. Clear the machine, and use the non-add key to number each problem.
2. Add, by the touch method, the items in Problems 1 and 2, and non-add those items followed by an "N."
 - a. Depress the keys for the figures in the number as usual.
 - b. Depress the non-add key and operate the motor bar or the handle. On some machines, the non-add key is "live" and therefore does not require the use of the motor bar for printing the item.
3. Complete Problems 3-5 by using the procedures outlined for Jobs 11 and 12.
4. Follow the instructions presented in Job No. 13 to work Problems 6-10.
5. Complete the Timed Drill, following the procedures used in previous jobs.

(33)

JOB No. 14 (Cont'd.)

6. Attach the tapes to the left side of this job sheet.
7. Fill in the information required at the top of the sheet.
8. Give the completed job to your instructor.

The Non-Add Key



(34)



SUBTRACTION AND CORRECTION OF ERRORS

Overview

This job introduces problems in subtraction and the correction of errors that are discovered after the amount has been printed on the tape. Subtraction, like addition, is performed by the touch method. With practice, your speed in subtraction should equal that developed for addition.

The subtraction key is located at either the upper or lower right-hand side of the keyboard and is marked with a minus (-) sign. It can be a "live" subtraction key, in which case amounts are subtracted by merely depressing this key. In order to subtract on other electrically or manually operated machines, the motor bar or handle must be operated after the subtraction (-) key has been depressed.

If an error is discovered after an amount has been added and printed on the tape, it can be corrected quickly and accurately by the subtraction of the entire incorrect item. Thus the error is eliminated and you can then enter the correct figure.

Procedure

1. Clear the machine, and number each problem.
2. Use the touch method developed in the previous jobs to do Problems 1-10.
 - a. In Problem 1, depress the keys for the top number, known as the **minuend**, 53.37, and operate the motor bar.

(35)

JOB No. 15 (Cont'd.)

- b. Enter into the machine the number to be subtracted, known as the **subtrahend**, 2.50.
 - c. Depress the subtraction (—) key located at the right of the keyboard, and operate the motor bar or handle. If your machine is equipped with the "live" subtraction key, merely depress it.
 - d. Take a total as usual, and record the answer 50.87 in the space provided.
3. Use the touch method to add the items in Problems 11–15, and use the following procedure for the items followed by "Er":
- a. Items marked "Er" are those for which the wrong figures were depressed and printed on the tape.
 - b. Depress the keys for these numbers as they appear in the problem.
 - c. Depress the same keys a second time, operate the subtraction key, and depress the motor bar or pull the handle.
 - d. Depress the keys for the next item, which is the correct figure.
 - e. In the future, use this method for correcting errors in numbers that have already been printed.
4. Complete the Timed Drill and follow the procedures used in previous jobs.
5. Attach the tapes to the left side of the job sheet.
6. Fill in the information required at the top of the job sheet.
7. Give the completed job to your instructor.

16

THE SUBTOTAL

Overview

This job features the use of the subtotal key or bar. It is used to determine the total of the items listed up to a certain point without clearing the machine. The subtotal is preceded by a space and is printed in red by some machines. On other machines, it is indicated by an "S" or by some other special symbol.

Procedure

1. Clear the machine, and number each problem.
2. Use the touch method to depress the keys for the items in each of the five problems.
3. Take a subtotal at the point in each problem indicated by a **heavy single line**.
 - a. On hand-operated Underwood Sundstrand machines, pull the handle twice.
 - b. On other hand-operated machines, pull the handle once, depress the subtotal key, and pull the handle down again.
 - c. On electrically operated models:
 - (1) On the Underwood Sundstrand machine, depress the motor bar — on some machines, twice.
 - (2) On other machines, depress the motor bar to leave a space between the last item and the subtotal. Then depress the subtotal key and the motor bar, if necessary.

JOB No. 16 (Cont'd.)

d. On the automatic printing calculators:

- (1) On the Remington Rand, operate the motor bar, then depress the subtotal key at the left of the keyboard. Operate the motor bar a second time.
 - (2) On the Olivetti Tetractys and the Underwood Sundstrand, depress the subtotal key immediately after depressing the keys for the number after which the subtotal is desired. On the Underwood, the subtotal and the motor bar (+) are one. On the Olivetti Tetractys, the subtotal keys are located under the total keys and are marked with a diamond-shaped asterisk.
 - (3) On the Victor, move the lever (located at lower right corner) up, and depress the motor bar. Be sure to move the lever down again to get a total.
4. Complete Problems 1-5, recording the subtotals and the totals in the spaces provided.
 5. Complete the Timed Drill, and follow the procedures used in the previous jobs.
 6. Attach the tapes to the left side of the job sheet.
 7. Fill in the information required at the top of the job sheet.
 8. Give the completed job to your instructor.



The Subtotal Key

(38)



CREDIT BALANCES AND ZEROS IN MULTIPLICATION

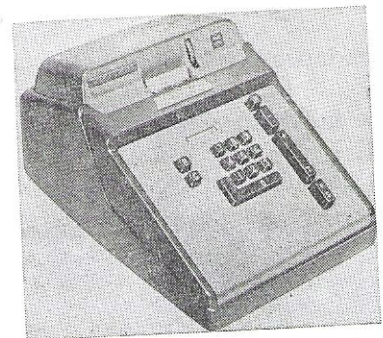
Overview

This job introduces the procedure to be followed to obtain credit balances on machines with or without a credit balance feature.

It also presents the procedure to be followed when the multiplier contains zeros.

Procedure

1. Clear the machine, and number each problem.
2. Follow this procedure for solving Problem 1:
 - a. Depress, by touch, the keys for 114.20, and operate the handle or motor bar.
 - b. Depress the keys for the number to be subtracted and the subtraction (−) key.
 - c. Operate the motor bar or the handle.
 - d. Take a total as usual. If your machine has a credit balance feature, the total will be labeled "Cr" or "−."
 - e. Record your answer as 458.52 Cr.
 - f. If your machine does **not** have a credit balance feature, the total will be 999,541.48. Depress the keys for the negative balance 999,541.48, and operate the subtraction key or bar using the motor bar or handle.
 - g. Take a total again to get the true credit balance of 458.52.
3. Work Problems 2-10 in the above manner.



Victor Ten-Key Adding Listing Machine

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4. To complete Problems 11-15, follow the steps listed below for solving Problem 11:
 - a. Add, by touch, the items that are not followed by a minus (-) sign and subtract those that are.
 - b. Take a total as usual.
 - c. On machines without a credit balance feature, follow steps **f** and **g** above to get the answer, 61.17 Cr.
5. To complete Problems 16-19, follow the usual multiplication steps and apply this rule: depress the zero bar **once** for **end** zeros in the multiplier and **twice** for any other single zero in the multiplier.
 - a. The fully automatic printing calculators have zero multiplication keys; hence no special rule is needed — just depress the zero key for any zero in the multiplier.
 - b. On the Underwood printing calculator, depress the (STOP) key located at the upper left of the keyboard before multiplying by the last digit of a multiplier when the multiplicand ends in a zero.
6. Complete the Timed Drill, following the procedures used in the previous jobs, and figure your GSPM.
7. Attach the tapes to the left side of the job sheet.
8. Fill in the information required at the top of the job sheet.
9. Give the completed job to your instructor.



DIVISION

Overview

Division on a standard ten-key adding listing machine is accomplished by multiplying the number to be divided, the dividend, by the reciprocal of the divisor. The **reciprocal** of a number is the answer obtained by dividing 1 by the divisor.

Division on a printing calculator is direct and semiautomatic. Detailed instructions for dividing on the Remington Rand, Underwood Sundstrand, Olivetti Tetractys, and Victor are given in this job.

Procedure

Standard Ten-Key Adding Machine

1. Clear the machine, and number each problem.
2. To solve Problem 1, depress, by touch, the keys for the dividend, 1729, and latch down the repeat key, if necessary.
3. Look up the reciprocal for the divisor, 200. The table shows it to be .005.
4. Multiply by the extreme right-hand figure, 5. Since the other two figures are zeros, you do not have to multiply by any other figure.
5. Take a total. The answer printed on the tape will be 86.45. Ignore the automatically printed decimal point.
6. Count the decimal places in the reciprocal. There are three in .005. Point off three places in the answer you write on the job sheet. The correct answer is 8.645.
7. Complete the remaining division problems in the same way.
8. If the capacity of your machine makes it impossible to use every figure in the reciprocal, begin multiplying with the fifth figure, counting from

the left. Point off five places in the answer but record only the whole numbers. The answer for problem (31) would be listed as 122, if you use only five figures and as 122.096 if you use all figures or a printing calculator. (If you use all reciprocal figures, round off the answer to three decimals.)

PRINTING CALCULATORS

Remington Rand

To complete Problems 1-40, follow the steps listed below for Problem 1.

1. Clear the machine, and number each problem.
2. Depress the keys for the dividend, 1729.
3. Depress the zero key three times to produce three decimal places in the quotient.
4. Move the **decimal indicator**, located at the upper left of the machine, to three on the quotient scale.
5. Depress the motor bar:
6. Depress the keys for the divisor, 200, but **do not** depress the motor bar.
7. Bring the left edge of the divisor, 200, even with the left edge of the dividend, 1,729.000, by depressing the **positioning key** (♦) four times. (On some of the older models, you will use the zero key to position the divisor.)
8. The rule for positioning the divisor is: depress the positioning key as many times as there are digits in the dividend less the number of digits in the divisor. In Problem 1, 7 digits in 1,729.000 less 3 digits in 200 equals 4, the number of times the positioning key must be depressed.

9. Depress the division (DIV) key located at the upper left corner of the machine. The machine will automatically complete the problem and print the answer vertically at the extreme left of the tape. If there is a remainder, it will be printed at the end of the solution to the problem.
10. The decimal indicator will indicate where the decimal point is to be placed in the answer — 8.645.
11. Print the decimal point by turning the cylinder knobs until the ribbon covers the last three figures of the answer, and depress the (D) key.

Underwood Sundstrand

To complete Problems 1-40, follow the instructions listed below for Problem 1:

1. Clear the machine, and number each problem
2. Depress the keys for the dividend, 1729, and three zeros to produce three decimal places in the answer.
3. Operate the motor bar.
4. Depress the keys for the divisor, 200, but **do not** operate the motor bar.
5. Bring the left edge of the divisor, 200, even with that of the dividend, 1,729.000, by depressing the zero key four times.
6. Depress the (DIV) key (located at the right of the 6 key).
7. Locate the decimal point in the quotient by:
 - a. Drawing a vertical line on the tape from the decimal point in the dividend, 1,729.000, to the decimal point in the divisor, 200.0000.
 - b. Drawing a horizontal line from the end of the vertical line to the quotient at the left of the tape.

Olivetti Tetractys

1. Clear the machine, and number each problem.
2. Depress the keys for the dividend, 1729, and the triple zero key (000).
3. Depress the green **add** key (+D).
4. Depress the keys for the divisor, 200, and operate the division key ($\div$) located at the left of the keyboard.
5. Point off three places in the quotient, 8.645.

Victor

1. Clear the machine, and number each problem.
2. Push control lever down; " $\div$ " will appear at the left of keyboard.
3. Depress keys for 1,729, three zeros, and the motor bar.
4. Depress keys for 200 and the motor bar.
5. Point off three places in the quotient, 8.645.

After completing the review problems, do the following:

1. Complete the Timed Drill, following the procedure used in the previous jobs and figuring your GSPM.
2. Attach the tapes to the left side of the job sheets.
3. Fill in the information required at the top of the job sheets.
4. Give the completed job to your instructor.

Overview

In this job, you will use the ten-key adding listing machine to work out solutions to practical problems connected with the office work done in the sales and accounting departments of modern business offices.

Procedure

To complete the WEEKLY SALES REPORT:

1. Clear the machine, and number each tape.
2. Use the touch method to add vertically the sales made on **Mon.** and record the total in the space provided.
3. Add the sales for **Mon.** again, and place a check mark ($\checkmark$) under the correct total to indicate that its accuracy has been verified.
4. Find and verify the totals for the sales in the vertical columns headed **Tues., Wed., Thurs., Fri.,** and **Sat.** as you did for the column for **Mon.**
5. Use the touch method to add the departmental sales for **Dept. 101** listed horizontally on the first line of the WEEKLY SALES REPORT. Record the total in the space provided at the right of the line.
6. Verify the total by adding it a second time.
7. Find and verify the totals of the departmental sales for the remaining departments. Follow the procedure outlined for Dept. 101.

8. Add the horizontal totals listed in the last column and record the total in the last space provided at the right of the line labeled "Totals."
9. Prove the accuracy of all the additions by:
 - a. Adding the totals of the **vertical additions** under the columns for the days of the week.
 - b. Checking this total against the total of the horizontal additions of departmental sales under the last column, "Total." They should be the same.

To complete the Timed Drill:

1. Use the touch method to add each of the six columns of figures vertically.
2. Use the touch method to add each of the departmental sales figures horizontally.
3. Use the touch method to add the figures listed in the "Total" column.
4. Follow the procedure used in previous jobs to determine your speed.

When all problems and the drill have been completed:

1. Attach all tapes to the left side of the job sheet.
2. Fill in the information required at the top of the job sheet.
3. Give the completed job to your instructor.

This job requires the application of all the operating principles presented in Job Nos. 11-19.

Procedure

1. Clear the machine, and number each problem.
2. Record the answer directly below or beside each problem and in the answers column at the right of the page.
3. In the spaces provided, record the time the job was started, the time it was completed, the number of minutes required to complete the job, and the GROSS STROKES PER MINUTE.
4. To compute the GSPM, first locate the last number you worked on during the timed review. Then find the nearest small figures (stroke count) above the number you used last. Count the number of strokes you used beyond this point and add the number to the stroke count. Divide the total by the number of minutes it took to complete the job or to do as much as you were able to do in the testing period. You may use the reverse of this page to do your figuring.
5. Arrange the tapes in numerical order and attach them to the upper left corner of the job sheet.
6. Write your name and other required information at the top of the job sheet.
7. Give the completed job to your instructor.

(Page 48 not required.) (47)



ADDITION

Overview

Office machines that are classified as **rotary calculators** can be readily identified because they have:

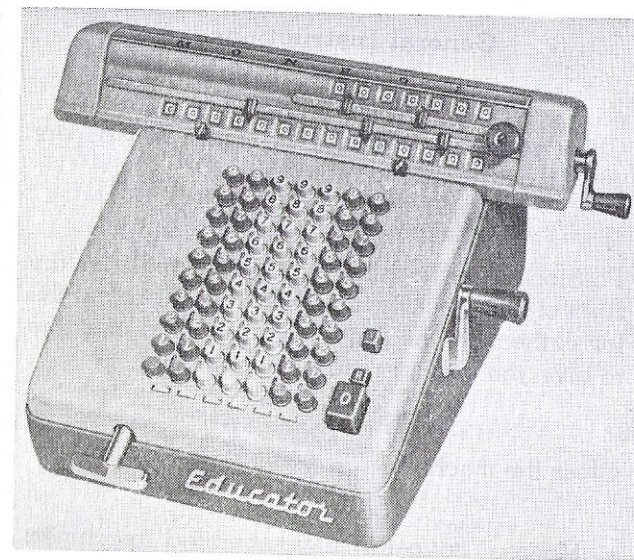
1. A movable carriage with two sets of "rotating" answer dials – a short set of dials called the **counter dials**, and a long set called the **register dials**.
2. Hand-operated models with a **dials clear-out crank** attached to the right-hand side of the carriage and a **carriage knob** a little to the left of the dials clear-out crank.
3. Electrically operated models with **dial locks**, **tab stops**, and **constant multiplier** levers attached to the movable carriage.
4. Both hand-operated and electrical models with a series of decimal markers attached to both the counter and register dials of the carriage.
5. A keyboard with 7, 10, or more rows of keys each of which begins with 1 at the end of the machine nearest the operator and ascends to 9 at the opposite end.
6. Hand-operated models with an operating crank located on the right-hand side of the machine and a carriage shift lever located on the lower left-hand side. A repeat, non-repeat, and master clear key complete the operating parts of the average hand-operated calculator.
7. Electrically operated calculators with minus(-), plus(+), multiplier and division keys, and carriage shift bars as well as a series of clear and tabular keys.

Rotary calculators include the Monroe, Marchant, Diehl, and Friden. All makes have hand-operated, semi-automatic, and fully automatic models. Rotary calculators are used in solving problems that involve addition, subtraction, multiplication, and division, provided a list of items on a tape is not necessary. The problems are solved by depressing

ROTARY CALCULATOR



Monro-Matic Calculator



Monroe Hand-operated Educator

keys in columns on the keyboard and by operating the crank or, if the machine is operated electrically, by depressing the motor bar. All answers appear in the dials in the movable carriage at the top of the machine.

The arrangement of the keys on the keyboard of a rotary calculator makes possible the use of the **multiple-key depression** technique which enables an operator to depress two or more keys with only one or two hand motions. To do this, an operator uses his thumb, and first and second fingers to depress the keys for a number, and the third or fourth finger to operate the motor bars.

The operating instructions for the rotary calculator will include the hand-operated, semi-automatic, and fully automatic models.

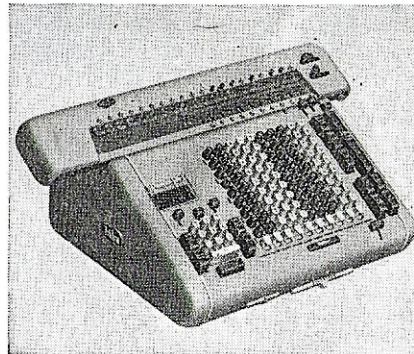
General Instructions

1. Clear your desk or table of books and papers that do not pertain to the course.
2. Position your machine at a slight angle at the right of your desk or table. Place this book at the left of the machine. Move both book and machine to give you ease of reading and writing.

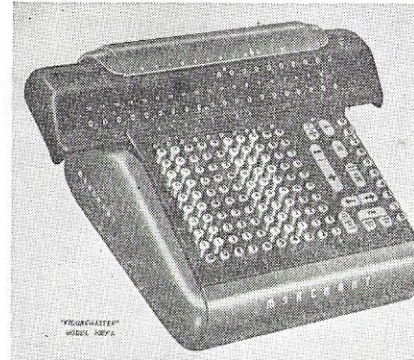
3. Clear the machine.

a. Monroe Educator hand-operated machines:

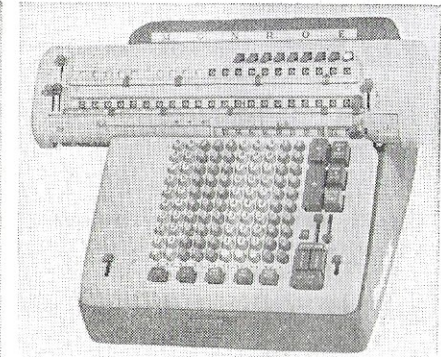
- (1) Depress the large (0) key located in the lower right-hand corner of the keyboard.
- (2) Turn the **dials clear-out crank**, located at the right end of the carriage, clockwise to clear the **upper** or **counter dials** and counterclockwise to clear the **lower** or **register dials**.
- (3) Move the carriage to extreme left by using the carriage knob, located on the right of the carriage, to **lift** the carriage and guide it to the number 1 position.
- (4) Depress the non-repeat key — an unmarked key just above the key marked "R" at the right of the keyboard.
- (5) Move the operating crank so that it is directly in line with the arrow on the keyboard. If the crank is not in the



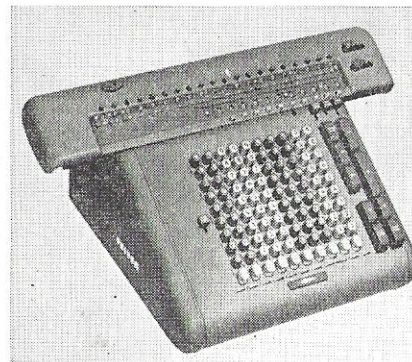
Friden Fully Automatic
Calculator



Marchant Fully Automatic
Calculator



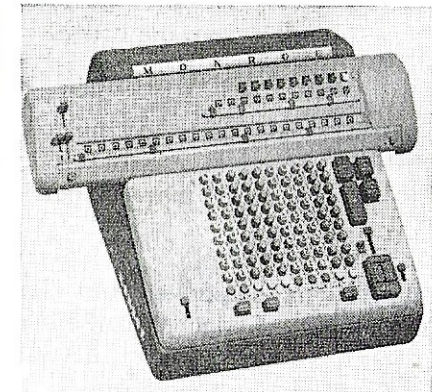
Monroe Fully Automatic
Calculator



Friden Semi-automatic
Calculator



Marchant Semi-automatic
Calculator



Monroe Semi-automatic
Calculator

JOB No. 21 (Cont'd.)

"12 o'clock" position, the machine locks. To unlock it, just jiggle the crank slightly back and forth so that it can be brought to the exact clearing point indicated by the arrow.

b. Monroe electrically operated machines:

- (1) Depress the (CLEAR MULT) and (KB CLEAR) keys. All dials will clear, and the carriage will return to the number 1 position.
- (2) Depress the non-repeat key.
- (3) Move the change lever, located at the right of the repeat key, to X.

c. Marchant electrically operated machines:

- (1) Depress the left shift bar marked with an arrow pointing to the left to move the carriage to the number 1 position.
- (2) Depress the three clear keys, located at the lower right corner of the machine, (UPPER DIAL), (MIDDLE DIAL), and (KEYBOARD DIAL) or (LOCK OR CLEAR). This can be done in one hand motion by using the first three fingers of the right hand.
- (3) Move the upper dial control, located at the extreme upper right of the keyboard, **away** from you.

d. Friden electrically operated machines:

- (1) Move the (ADD) key, located at the upper right corner, **down**.
- (2) Move the (KB LOCK) key, located at the upper right corner, **up**.
- (3) Depress the (CARR CLEAR) and the (KB CLEAR) bars, using the first and second fingers of the right hand.
- (4) Move the (CTR CON) key, located above the multiplier keyboard, **up**.

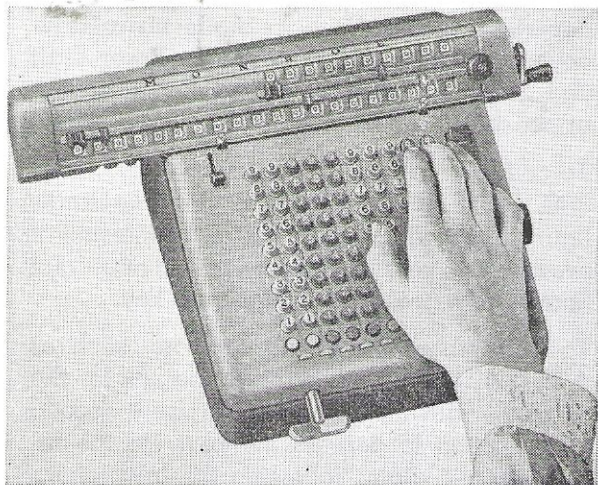
Procedure

To add the numbers in Problem 1:

1. Depress 9 in the first column at the extreme right of the keyboard with the first or index finger. Turn the crank clockwise or depress the plus (+) bar with the fourth or little finger. The number 9 will appear in the register dials and 1 in the counter dials.
2. Depress 9's, **simultaneously**, in the first and second rows of keys at the extreme right of the keyboard with the first and second fingers. Turn the crank clockwise or depress the plus (+) bar with the fourth or little finger. The number 108 will appear in the register dials and 2 in the counter dials.
3. Depress 9's, **simultaneously**, in the first, second, and third rows of keys at the extreme right of the keyboard with the first, second, and third fingers. Then turn the crank clockwise or depress the plus (+) bar. The number 1107 will appear in the register dials and 3 in the counter dials.
4. Follow the same procedure in handling the other numbers in this problem.
5. The answer to Problem 1 is 3750.
6. Write the answer directly below the problem in the space provided, and immediately do the problem a second time. In reading the numbers the second time, begin at the bottom and work up.
 - a. If the second answer is the same as the first, write it in the answer column at the right.

- b. If the second answer is different from the first, write it directly below the first answer and do the problem again. Write the answer that proves to be correct in the Answers column.
7. Use the following fingering technique to depress the keys for the numbers in the remaining problems of this job:
 - a. To add numbers containing one digit such as 9, 10, 200, 3000 (since zeros are not depressed, they are not counted as digits), depress the proper figure key with the first or index finger and the plus (+) bar with the fourth or little finger.
 - b. To add numbers containing two digits, when two digits are the same, or when the right digit is not more than three greater than the left digit such as 88, 89, 79, 69, 507, 407 (zeros are not counted as digits), depress the keys for both digits **simultaneously**, using the first and second fingers.
 - c. To add other two-digit numbers, such as 19, 82, 804, 308 (zeros are not counted as digits), depress the keys for both digits **simultaneously**, using the thumb on the lower digit and either the first or second finger on the upper digit.
 - d. To add three-digit numbers such as 115, 227, 338, 822, 733, depress the two like lower figure keys with the thumb by centering it over the two keys and either the first or second fingers to depress the other figure key.
 - e. To add other three-digit numbers, such as 4.15, 7.41, 5.71, 1.54, depress the key for the left digit with the first finger. Use a second hand motion to depress the keys for the remaining two digits, following the instructions given above for adding two-digit numbers.

- f. To add four-digit numbers such as 44.88, 13.57, 45.35, use two separate hand motions to depress two keys at a time, following the instructions given above for adding two-digit numbers.
- g. To add numbers containing zeros, depress the other digits as indicated above, but **do not** depress any keys for the zeros. Zeros are ignored except as they affect the columns in which other digits in the number fall.
- h. When a problem contains decimals, move or flip over a decimal marker on the keyboard and register dials so that they correspond with the position of the decimal points in the problem. (For this job, the decimal marker should be placed between columns 3 and 2.)
8. When all problems have been completed and the answers verified, follow the procedure used on previous jobs for turning in the completed job to your instructor.



Fingering Technique Used to Depress the Keys for .99

(54)

22

FIVE- AND SIX-DIGIT ADDITION AND REPEAT ADDITION

Overview

This job introduces five- and six-digit addition and the use of the repeat (R) key, the multiplication (X) bar, and multiplier keys for repeat addition.

Procedure

1. Clear the machine, position the carriage, and prepare the machine for addition as you did in Job No. 21:
 - a. All figure keys released.
 - b. Both dials cleared.
 - c. Carriage moved to the extreme left.
 - d. Decimal markers on keyboard and register dials between columns 2 and 3.
 - e. Crank moved to highest point on hand-operated models.
 - f. Add lever, if any (Friden), **down** and (KB LOCK) **up**.
2. Use the following multiple-key depression techniques to add five-digit numbers such as 135.67:
 - a. Use the first finger to depress 1, the left digit of the number, in column five of the keyboard.
 - b. Divide the remaining four digits into two equal groups.
 - c. Using the fingering techniques developed in Job No. 21, depress 35, the left two digits, in column four and three. With a separate hand motion, depress 67, the remaining two digits, in columns two and one.
 - d. Operate the crank or depress the plus (+) bar.

(55)

JOB No. 22 (Cont'd.)

3. Use the following multiple-key depression techniques to add six-digit numbers such as 4,175.96.
 - a. Divide the number into three equal groups.
 - b. Using the fingering techniques developed in Job No. 21, depress 41 in columns six and five of the keyboard. With a second hand motion, depress 75 in columns four and three. With a third hand motion, depress 96 in columns two and one.
 - c. Operate the crank or depress the plus (+) bar.
4. Instructions for repeat addition:
 - a. To repeat-add 21.98 five times on hand-operated machines:
 - (1) Use two separate hand motions to set 21.98 on the keyboard
 - (2) Depress the repeat (R) key.
 - (3) Operate the crank five times.
 - b. To repeat-add 21.98 five times on **electrically** operated machines:
 - (1) Follow steps (1) and (2) above.
 - (2) On Monroe machines, depress the plus (+) bar five times.
 - (3) On Marchant semi-automatic, depress the multiplication (X) bar five times.
 - (4) On Marchant fully automatic, depress add (+) bar and the "5" multiplier key located at the right of the keyboard.
 - (5) On the Marchant Deci-Magic, depress the keyboard (LOCK) and tap the plus (+) bar five times. To release the (LOCK) key, depress the (KB CLEAR) key.
 - (6) On the Friden, move (ADD) key to **up** position and depress the plus (+) bar five times.
 - c. On all models, clear the keyboard and follow the same procedure for the next series of like numbers.
5. Complete the Timed Drill, and give the completed job to your instructor.

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SUBTRACTION AND CREDIT BALANCES

Overview

This job introduces subtraction and the procedure to be followed to obtain a credit balance.

Procedure

1. Clear the machine, position the carriage, and prepare the machine for addition.
2. To subtract for Problems 1 - 10, follow the procedure given below for Problem 1.
 - a. Depress the keys for the top number, 3.50, at the extreme right of the keyboard.
 - b. Operate the crank clockwise or depress the plus (+) bar. The number 3.50 will appear in the register dials.
 - c. Depress the keys for the number to be subtracted, 1.25, also at the extreme right of the keyboard.
 - d. Operate the crank counterclockwise one complete revolution. On electrical models, depress the minus (-) bar with the fourth finger. The counter dials will contain zeros, which indicates that one number has been subtracted.
 - e. The remainder, 2.25, will appear in the register dials. Record the answer under the problem, but **do not clear the dials**.
 - f. Verify the answer by adding the subtrahend, 1.25, to the remainder, 2.25, which is still in the register dials.
 - g. If the dials show 3.50, the minuend, the answer has been verified and should be recorded in the Answers column at the right. If the dials do not show 3.50, do the problem again.

(57)

JOB No. 23 (Cont'd.)

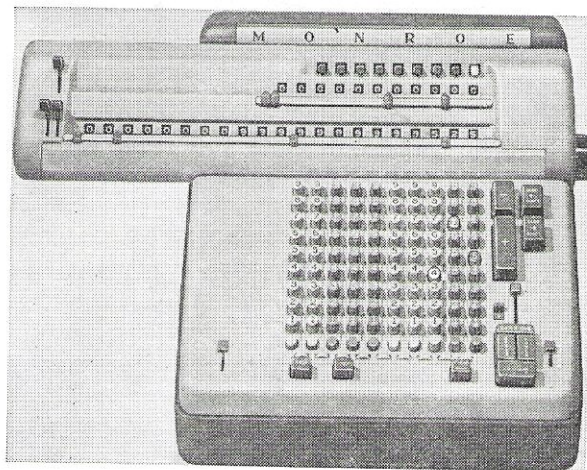
3. Clear the machine and do the remaining problems.
4. To subtract 12.25 from 7.50—Problem 11:
 - a. Add the minuend, 7.50, as usual.
 - b. Subtract the subtrahend, 12.25, following the procedure listed for Problem 1 above.
 - c. The number in the register dials, 5.25 preceded by a series of 9's in all the remaining dials, is the complement of the credit balance.
 - d. To get the true credit balance:
 - (1) Depress the same keys on the keyboard as the figures appearing in the register dials directly above each row of keys. In Problem 11, those will be 9,999,525, or 525 preceded by as many 9's as there are additional columns on the keyboard.
 On the Monroe, depress the repeat key, and subtract twice. The first subtraction clears the register dials; the second furnishes the actual credit balance, 4.75.
 On the fully automatic Friden, move the (ADD) key to the **up** position **before** subtracting twice.
 On the semi-automatic Marchant, depress the red short-cut bar twice.
 On the fully automatic Marchant, depress, simultaneously, the minus (—) bar and the "2" multiplier key at the right of the keyboard.
 On the Marchant Deci-Magic, depress the (MD CLEAR) key and the minus (—) bar.
 - (2) Record the answer, 4.75 Cr., under Problem 11, but **do not clear the machine**.
 - (3) Verify the answer by clearing the keyboard, if necessary, and adding the

(58)

JOB No. 23 (Cont'd.)

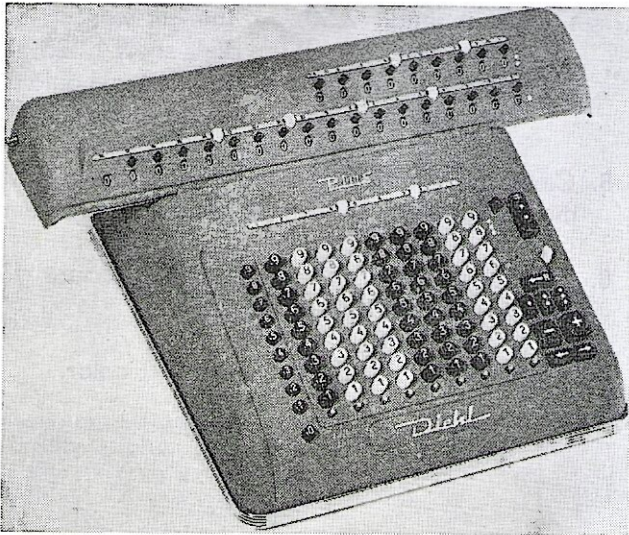
minuend, 7.50, to the answer in the register dials. If the dials show 12.25, the answer has been verified and should be recorded in the Answers column.

5. Clear the machine (on the Friden, move down the (ADD) key), and do the remaining problems.
6. Do the Timed Drill, using the procedure you followed in Job No. 22.
7. Give the completed job to your instructor.



Lower Dials Showing Complement of the True Credit Balance

(59)



Diehl Fully Automatic Calculator with Push-Button Multiplication

(60)

24

MULTIPLICATION

Overview

This job introduces problems involving multiplication. Multiplication on a rotary calculator, as on any other adding device, is accomplished by repeated addition.

Procedure

1. Clear the machine and position the carriage as usual.
2. To complete Problem 1 on hand-operated models:
 - a. Depress the keys for the number to be multiplied, 148, at the right of the keyboard.
 - b. Depress the repeat (R) key, and add the number seven times by turning the crank forward seven times. The number 1036 will appear in the register dials, while 7 will appear in the counter dials.
 - c. Use the carriage shift lever to move the carriage one place to the right. The carriage shift lever is located below the keyboard and toward the left of the machine.
 - d. With keys for 148 still depressed on the keyboard, turn the operating crank forward six times to multiply by the second number in the multiplier.
 - e. The answer, 9916, will appear in the register dials. The multiplier, 67, will appear in the counter dials, and the number to be multiplied will still be depressed on the keyboard.
 - f. After writing the answer on the line provided, clear the dials and the keyboard, and then shift the carriage back to the extreme left.

(61)

3. Complete Problems 2 - 15 in the manner outlined above. When the multiplier contains more than two digits, repeat steps **c** and **d** for each additional digit.
4. On electrically operated models, do the problems the same way as on hand-operated models, with the following exceptions:
 - a. On the Monroe, you depress a plus (+) bar instead of operating a crank, and on most models, you depress carriage shift keys (↵) (➡) instead of using a carriage shift lever. You clear the machine and return the carriage in one motion by depressing the (CLEAR MULT) key.
 - b. On the Marchant semi-automatic, there is no repeat key. You depress a multiplication (X) bar instead, and there is no crank to operate. There are carriage shift keys (↵) (➡) rather than a carriage shift lever.
 - c. On Friden semi-automatics, you move an (ADD) key **up** instead of depressing a repeat key. There is a plus (+) bar instead of a crank to operate, and carriage shift keys (↵) (➡) instead of a carriage shift lever.
5. Complete the Timed Drill:
 - a. Multiply the number of cases (second column) by the number of articles in each case (third column) and record the answer in "No. on Hand" (fourth) column.
 - b. Add vertically the items in the second and fourth columns, and record the totals in the spaces provided.
 - c. Compute your GDPM as per instructions in Job No. 22.
6. Give the completed job to your instructor.

(62)



DIVISION

Overview

This job introduces problems in division. Division consists of a series of subtractions. Rotary calculators, especially the fully automatic ones, are well adapted to this type of problem.

Procedure

1. To divide in Problem 1, on hand-operated machines:
 - a. Clear the machine and position the carriage as usual.
 - b. Depress the keys for the dividend, 8,288, at the right of the keyboard, and add it into the register dials.
 - c. Clear the counter dials of the figure 1.
 - d. Depress the keys for the divisor, 112, also at the right of the keyboard.
 - e. Shift the carriage one place to the right so that the 8 in 8,288 in the register dials is directly above the 1 in 112 on the keyboard.
 - f. Depress the repeat key, if necessary.
 - g. Subtract 112 from 828 of 8,288 as many times as possible until the remainder is less than the divisor, 112. (If the divisor is subtracted too many times, bell will ring, and a series of 9's will appear in the register dials. To correct this, simply add the divisor into the machine **once**.) The figure 7 will appear in the counter dials, and the figures 448 will appear in the register dials.
 - h. Shift the carriage one place to the left.
 - i. Subtract 112 from 448 until the remainder is less than the divisor. In this problem, 112 is subtracted four times without a remainder. The figure 4 will appear to the right of 7 in the counter dials. As nothing is left in the register dials, you know that the problem came out even and that the answer is 74.

(63)

2. On semi-automatic machines:

- a. Enter 8,288 at the right of the keyboard, and add it into the register dials. (On some models, depress the third tab stop and the (DIVD TAB) bar.)
 - b. Clear the figure 1 out of the counter dials, if necessary.
 - c. Depress the repeat key. On the Friden, move the (ADD) key **down**.
 - d. Enter the divisor at right of the keyboard.
 - e. Shift the carriage one place to the right so that the 8 in 8288 in the register dials is directly above the 1 in 112 on the keyboard.
 - f. Depress the division ($\div$) key (on the Friden, both division keys; on the Monroe Educator, move lever up to $\div$ position).
 - g. The quotient (answer) will appear in the counter dials.
3. Clear the machine and follow the same procedure to complete the remaining division problems.
 4. Complete the Timed Drill and compute your GDPM.
 5. Give the completed job to your instructor.



ADDING AND SUBTRACTING CONSTANTS

Overview

A constant is a number that reoccurs in a series of problems. By using the repeat key, or the multiplication keys or bar, and the subtract key, it is possible to keep the constant in the machine until the entire series of problems is completed.

Procedure

To complete Problems 1 - 15 of this job:

1. Clear the machine and position the carriage as usual.
2. Depress the keys for the constant in Problem 1, 4.85, and **add** it. The constant is now in the register dials and stays there until all five problems in which it appears have been completed.
3. Depress the repeat (R) key, if your machine has one. On the Friden, move the (ADD) key **up**. On the Marchant Deci-Magic, depress the (KB LOCK) key.
4. Depress the keys for the first number to be added to the constant, 12.75.
5. On the Monroe, Friden, and Marchant Deci-Magic, depress the plus (+) bar. On the Marchant semi-automatic, depress the multiplication ($\times$) bar. If your machine is fully automatic, depress the "1" multiplier key.
6. The answer, 17.60, will appear in the register dials; 2 will appear in the counter dials. Write the answer in the space provided.
7. Operate the subtraction mechanism on your machine without depressing any keys for the amounts involved. (The keys for the amount to be subtracted, 12.75, should still be depressed on the keyboard.)

JOB No. 26 (Cont'd.)

8. On the Monroe, Marchant Deci-Magic, and Friden, clear the keyboard. **Do not clear any other dials.** The constant, 4.85, should remain in the register dials.
9. Repeat steps 3, 4, 5, 6, 7, and 8 for each of the remaining problems in this series.

To complete Problems 16-30 of this job:

1. Clear the machine and position the carriage as usual.
 2. Depress the keys for the constant in Problem 16, 1,500, and subtract it from zero. The register dials will show 999,998,500. (The number of 9's will depend upon the size of your carriage.)
 3. Depress the repeat (R) key. On the Friden, move the (ADD) key **up**. On the Marchant Deci-Magic, depress the (KB LOCK) key.
 4. Depress the keys for the first number from which the constant is to be subtracted, 17,550.
 5. On the Monroe, Friden, and Marchant Deci-Magic, depress the plus (+) bar. On the Marchant semi-automatic, depress the (X) bar; on the fully automatic, the "1" multiplier key.
 6. The answer, 16,050, will appear in the register dials; 0 will appear in the counter dials. Write the answer in the spaces provided.
 7. Operate the subtraction mechanism without depressing any keys for the amounts involved.
 8. On the Monroe, Friden, and Marchant Deci-Magic, clear the keyboard. **Do not clear the other dials.** The constant figures, 999,998,500, should remain in the register dials.
 9. Repeat steps 3, 4, 5, 6, 7, and 8, for each of the remaining problems in this series.
- Complete the Timed Drill and compute your GDPM. Give the completed job to your instructor.

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MULTIPLICATION INVOLVING CONSTANTS

Overview

This job introduces problems that include a constant multiplicand. A constant multiplicand is a number that is to be multiplied by several different numbers. To save operations, the constant is held in the machine until the entire series is completed.

Procedure

1. Clear the machine; position carriage as usual.
2. For Series One, depress the keys at the right of the keyboard for the constant, 1.45.
3. Lock it on the keyboard by:
 - a. On the Monroe, depressing the repeat key.
 - b. On the Friden, moving the (ADD) key **up**.
 - c. On the Marchant, using the multiplication bar (X) or the red (SHORT CUT) bar.
4. Multiply by the first multiplier, 37.
5. Write the answer, 53.65, in the space provided.
6. Without releasing the keys on the keyboard or clearing any of the dials, change the figures in the counter dials from those of the first multiplier, 37, to those of the second multiplier, 42. This is done by adding or subtracting as necessary.
 - a. Change the first figure of the counter dials, 3, to 4 by adding once, using the crank, the plus (+) bar, or on the Marchant, the multiplication (X) bar.
 - b. Shift the carriage one place to the left and change 7 to 2 by subtracting five times, using the crank, the minus bar or, on the Marchant, the red (SHORT CUT) bar.
 - c. Write the answer, 60.90, in the spaces provided.
 - d. Without clearing any figures out of the machine, change the figures of the second multiplier, 42, to those of the third multiplier, 26, using the same procedures described above.
7. When the first series has been completed, clear the machine of all figures; depress the keys for the constant in the next series; following the same steps, complete the remaining series.

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8. Complete the Timed Drill, and figure your GDPM.
9. Give the completed job to your instructor.

INSTRUCTIONS FOR THE FULLY AUTOMATIC FRIDEN

1. Move (ADD) key to **down** position.
2. Depress the keys for the constant, 1.45, on the small-multiplier keyboard, and move the (REP) key **down**.
3. Depress the keys, on the full keyboard, for the first multiplier, 37, and operate the (MULT) bar on the small-multiplier keyboard.
4. Record the answer in the spaces provided.
5. Use the same procedure for the remaining multipliers. To clear the small-multiplier keyboard at the end of the series, move the (REP) **up** and operate the (MULT CLEAR) bar.

INSTRUCTIONS FOR THE MARCHANT DECI-MAGIC

1. Depress decimal key 2 (bottom row of keys).
2. Enter constant, 1.45, around the fixed decimal marker, and depress the (X) bar.
3. Depress the (FRONT DIAL LOCK), to the right of (X) bar.
4. Enter the first multiplier, 37, around the fixed decimal, and depress the (POS=) key.
5. Enter the second multiplier, 42, around the fixed decimal, and depress the (X) bar, then the (POS=) key.
6. Follow the procedure outlined in step 5 for the rest of the multipliers in Series One.
7. Depress the (FRONT DIAL CLEAR) key, located at the lower right of the keyboard, to clear constant dial.

Overview

The keyboard of a rotary calculator does not have keys for common fractions. You must, therefore, use the decimal equivalents of fractions in order to add, subtract, multiply, or divide numbers containing fractions. All computations involving fractions are best made "around" a fixed decimal point. For the problems in this job, you should allow for five decimal places. Decimal equivalents for the problems in this job are given at the end of the Procedure.

Procedure

1. Clear the machine, and position the carriage as usual.
2. Place a decimal marker between the fifth and sixth rows of keys on the keyboard by moving the keyboard decimal marker (on the Marchant) or by flipping over the keyboard decimal marker (on the Monroe and Friden). On Marchant Deci-Magics, depress decimal key 5.
3. Move the register dials decimal marker so that it is between the fifth and sixth rows of keys.
4. To add $12 \frac{3}{4}$ in Problem 1:
 - a. Depress 1 and 2 in columns seven and six. (12 is a whole number and must appear to the left of the keyboard decimal point.)
 - b. Change $\frac{3}{4}$ to a decimal (.75) and depress 7 and 5 in columns five and four. (.75 is a decimal and must appear to the right of the keyboard decimal point.)
 - c. Depress the plus (+) bar, or operate the crank, to add the number.
5. To add $25 \frac{1}{8}$, the next number in Problem 1:

JOB No. 28 (Cont'd.)

- a. Depress 2 and 5 in columns seven and six of the keyboard.
 - b. Change $1/8$ to a decimal (.125) and depress 1, 2, and 5 in columns five, four, and three of the keyboard.
 - c. Depress the plus (+) bar, or operate the crank, to add the number.
6. Follow the same procedure for the remaining numbers in Problem 1. Be sure to keep whole numbers to the left of the decimal point and decimals to the right. The answer to Problem 1 is 528.25
7. Work Problems 2 - 5 in the same manner.
8. To subtract $15\frac{1}{2}$ from $80\frac{7}{8}$ in Problem 6:
- a. Change $80\frac{7}{8}$ to 80.875, and depress the proper keys, beginning at column seven of the keyboard.
 - b. Depress the plus (+) bar, or operate the crank.
 - c. Change $15\frac{1}{2}$ to 15.5, and depress the proper keys, beginning at column seven of the keyboard.
 - d. Depress the minus (-) bar or operate the crank. The answer is 65.375.
9. After Problem 15 has been completed, do the Timed Drill, compute your GDPM, and give the completed job to your instructor.

DECIMAL EQUIVALENTS

$1/2$	.5	$1/16$	.0625	$1/3$	.33333
$1/4$	.25	$3/16$	.1875	$2/3$	.66667
$3/4$	.75	$5/16$	.3125	$1/6$	.16667
$1/8$	.125	$7/16$	.4375	$5/6$	.83333
$3/8$	.375	$9/16$	.5625	$1/12$	.08333
$5/8$	.625	$11/16$	.6875	$5/12$	.41667
$7/8$	.875	$13/16$	.8125	$7/12$	.58333
		$15/16$	.9375	$11/12$	.91667

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MULTIPLICATION OVER FIXED DECIMAL POINTS

Overview

This job introduces multiplication problems involving decimals. The rule for pointing off decimal places is to point off as many decimal places in the answer as there are in the multiplier and the multiplicand **combined**. When the number of decimal places in a series of problems varies greatly, time can be saved by multiplying around a set of "fixed" decimal places on the keyboard and on the dials.

Procedure

1. Clear the machine, and position the carriage as usual.
2. On hand-operated models:
 - a. Place a decimal marker between the fourth and fifth rows of keys on the keyboard by moving the keyboard decimal marker (on the Marchant), or by flipping over the keyboard decimal markers on the Monroe and Friden). On Marchant Deci-Magics, depress decimal key 4.
 - b. Move the register dials decimal marker so that it is between the **eighth** and **ninth** dials.
 - c. Move the counter dials decimal marker so that it is between the **fourth** and **fifth** dials.
 - d. Depress the keys for the multiplicand, 25.5625, so that the whole number, 25, will be to the left of the fixed decimal point, that is, in the sixth and fifth columns; the other four figures, which are decimals, go to the right of the decimal point, that is, in the fourth, third, second, and first columns.
 - e. Move the carriage one place to the right because the multiplier contains only three decimals, which is one less than the maximum of four pre-set in the counter dials. (In Problem 2, you will have to move the carriage two places to the right because the multiplier contains only two decimals - two less than the maximum of four.

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- f. Depress the repeat (R) key and multiply in the usual manner. If the problem is done correctly, the multiplier, 3.875, will appear in the fifth, fourth, third, and second counter dials; the answer, 99.05468750 will appear in the register dials.
 - g. Record the answer as 99.05469. (Use only five decimals; if the sixth decimal is 5 or higher, add 1 to the fifth decimal.)
3. On the semi-automatic electrical models, follow the same procedure except:
 - a. On the Monroe, you depress the plus (+) bar instead of operating a crank.
 - b. On the Marchant, there is no repeat key; the keys remain depressed when the multiplication (X) bar is used.
 - c. On the Friden, you move the (ADD) key **up** instead of depressing a repeat key.
 4. Do the remaining multiplication problems. Before recording the answers, check the figures for the multiplicand on the keyboard and for the multiplier in the counter dials. Be sure that whole numbers appear at the left of the fixed decimal point and decimals at the right on both the keyboard and the counter dials.
 5. Complete the Timed Drill, and give the completed job to your instructor.



DIVISION OVER FIXED DECIMAL POINTS

Overview

In some situations, business needs require that a division be carried out two or more places beyond the decimal point. In such cases, you can save time by using the same decimal set-up used for multiplication of decimals.

Procedure

1. To complete Problem 1 of this job on **all** machines, clear the machine and set decimal markers as follows:
 - a. Counter dials – between 5 and 4.
 - b. Register dials – between 9 and 8.
 - c. Keyboard – between rows 5 and 4.
2. On hand-operated models:
 - a. Move the carriage so that the decimal point on the register dials is directly above the decimal marker on the keyboard.
 - b. Depress the keys for the dividend, 8761.25, around the fixed decimal point on the keyboard.
 - c. Add the dividend. The counter dials will show 1.0000; the register dials will show 8761.25000000.
 - d. Clear the counter dials.
 - e. Depress the keys for the divisor, 375.25, around the fixed decimal point on the keyboard.
 - f. Shift the carriage so that the left figure in the register dials is directly above the left figure of the divisor on the keyboard. If the divisor is greater than the dividend figures directly **above** it, shift the carriage one place to the **left** so that the divisor can be subtracted from the figures above and to the left of it.
 - g. Depress the repeat key, and repeatedly subtract

JOB No. 30 (Cont'd.)

the divisor until that portion of the dividend directly above the divisor becomes less than the divisor.

- h. Shift the carriage to the left, and complete the problem as any other division problem. The answer, 23.3477, will appear in the counter dials.
 - i. Clear the machine, and follow the same procedure to work the rest of the problems.
3. On semi-automatic models:
- a. Depress the keys for the dividend, 8761.25, around the fixed decimal point on the keyboard.
 - b. Move the carriage so that the decimal marker on the register dials is directly above the decimal marker on the keyboard.
 - c. Depress the plus (+) bar.
 - d. Clear the figure 1 out of the counter dials, if necessary.
 - e. Depress the repeat key. (On the Friden, move the (ADD) key down.)
 - f. Depress the keys for the divisor around the fixed decimal point on the keyboard.
 - g. Move the carriage so that the left figure on the register dials is directly above the left key for the divisor on the keyboard.
 - h. Depress the division ($\div$) key (on the Friden, both division keys; on the Monroe, move lever to $\div$ position).
 - i. The answer, 23.3477 will appear in the counter dials.
 - j. Clear the machine, and follow the same procedure to complete the remaining division problems.
4. Complete the Timed Drill, compute your GDPM, and give the completed job to your instructor.

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TRADE AND CASH DISCOUNTS

Overview

This job presents the computational procedures used to solve business problems that involve trade and cash discounts. You will learn three methods of solving these problems. In Method I, the discount is computed separately and deducted from the gross amount to obtain the net amount. In Method II, the gross amount is multiplied negatively by the discount in order to obtain the net amount directly. In Method III, double multiplication is used to obtain the amount of the discount and the net amount in one operation.

Procedure

METHOD I (Problems 1 - 15)

1. Clear the machine, and set up decimal markers (for multiplying only) thus:
 - a. Keyboard - between rows 3 and 2.
 - b. Register dials - between 5 and 4.
 - c. Counter dials - between 3 and 2.
 - d. On Friden multiplication keyboard - over 2.
 - e. On Marchant Deci-Magic - decimal key 2.
2. On Marchant fully automatic, depress tab key 2, and move the direction control to **left** position.
3. Change the percentage of discount to its decimal equivalent. (In Problem 1, the discount of 25% equals .25.) The problem is now one of multiplication of decimals over a fixed decimal point ($583.45 \times .25$).
4. Depress the keys for the amount 583.45 on the keyboard.
5. Shift the carriage to the proper position to multiply by .25, and follow the procedures listed in Job No. 29 for multiplication of numbers containing decimals.
6. The discount, 145.8625, will appear on the register dials. Record it as 145.86 in the space provided.
7. Subtract the discount, 145.86, from the gross amount, 583.45, and record the net amount, 437.59, in the spaces provided.

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JOB No. 31 (Cont'd.)

METHOD II (Problems 16 - 30)

1. On hand-operated models:

- a. Set decimal markers as per instructions for Method I.
- b. Enter the amount, 125.75, on the keyboard, and latch down the repeat key.
- c. Move the carriage so that the decimal marker on the register dials is directly above the decimal point on the keyboard.
- d. Add the amount. The register dials will show 125.7500, and the counter dials, 1.00.
- e. **Do not clear either series of dials.**
- f. Shift the carriage one place to the left.
- g. By subtraction, negatively multiply by .15, the decimal equivalent of 15%. (Turn the crank counterclockwise once, shift the carriage to the left, and turn the crank counterclockwise five times.)
- h. The answer, 106.8875, will appear in the register dials. The counter dials will show 1.15 or .85. Record the answer as 106.89 in the spaces provided.

2. On semi-automatic calculators, follow the procedure given for hand-operated calculators except use the minus (-) bar or the (SHORT CUT) bar instead of the crank. On Marchants, add by using (X) bar or (1) multiplier key. If your machine has a counter control lever, bring it down to the position that gives a positive count during the negative multiplication. On Monroes, move the lever to a $\div$ position; on other machines, move the lever toward you.

3. On fully automatic Monroe calculators:

- a. Clear the machine, and set up fixed decimal markers as for hand-operated machines.
- b. Depress 1.00 around the fixed decimal point on the keyboard, and operate the (SET UP) or (ENTER MULTIPLIER) key.
- c. Depress keys for the amount, 125.75, on the keyboard, engage the repeat key, and move the AUTO K B CLEAR lever to the right.

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JOB No. 31 (Cont'd.)

- d. Depress the (CLEAR MULT) key.
- e. Clear **only** the counter dials.
- f. Depress (SET UP) or (ENTER MULTIPLIER).
- g. Move the change lever (located on the lower right-hand side of the keyboard) to the $\div$ position.
- h. Depress keys for the discount, .15, on the keyboard.
- i. Depress the (NEG MULT) key. The answer, 106.8875, will appear in the register dials. Record it as 106.89 in the spaces provided.

4. On fully automatic Marchant calculators:

- a. Clear the machine, and set up fixed decimal markers as for hand-operated machines.
- b. Depress tab stop 3. See that the carriage direction control points to the left.
- c. Depress the keys for 125.75, and operate the (TAB) or (CARRIAGE RETURN) bar **only**.
- d. Depress multiplier key 1.
- e. Move the upper dials control (located at the upper right **side** of the machine) down.
- f. Depress the (REPEAT) and (NEG X) keys.
- g. Depress the 1 and 5 multiplier keys.
- h. The answer, 106.8875, will appear in the register dials. Record it as 106.89 in the spaces provided.

5. On the Marchant Deci-Magic:

- a. Depress decimal key 3.
- b. Enter 125.75 around the fixed decimal marker and depress the (KB LOCK) key.
- c. Depress the plus (+) bar, and tap the (MD LOCK) key.
- d. Depress the (X) bar, and tap the (KB CLEAR).
- e. Enter .15 around the fixed decimal, and tap the (=NEG) key.
- f. Record the answer, 106.89, and depress the (MD CLEAR) key.

5. On fully automatic Friden calculators:

- a. Clear the machine, and set up fixed decimal markers as for hand-operated machines. See that the (ADD) key is **up**.

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JOB No. 31 (Cont'd.)

- b. Depress the keys for the amount, 125.75, on the keyboard.
- c. Depress 1.00 on the multiplier keyboard.
- d. Depress the (MULT) bar.
- e. Depress the keys for the discount, .15, on the multiplier keyboard.
- f. Move the (CTR CON) key (located at the upper right of multiplier keyboard) **down**.
- g. Depress the (NEG MULT) bar.
- h. The answer, 106.8875, will appear in the register dials. Round it out to the nearest cent (106.89), and record it in the spaces provided.

METHOD III (Problems 31 - 45)

1. Clear the machine, and set decimal markers:
 - a. Keyboard — left of dials 10 and 2.
 - b. Register dials — left of dials 12 and 4.
 - c. Counter dials — left of dials 10 and 2.
 - d. Friden multiplication keyboard — over 2.
2. Depress the keys for the discount, .15, at the extreme right of the keyboard.
3. Depress the keys for .85 (100% - 15% equals 85%, or the per cent equivalent of the net amount) in columns 9 and 10.
4. Multiply by the amount of the invoice, 50.25. (On the Marchant fully automatic, set the directional control to the right, and multiply from right to left.)
5. The discount, 7.5375, will appear at the right of the register dials, and the net amount, 42.7125, at the left. Record the discount as 7.54 and the net amount as 42.71 in the spaces provided.
6. On Marchant Deci-Magics, enter 50.25 around the fixed decimal 2, and tap the (X) bar.
 - a. Enter .85 around decimal marker 10 and .15 around decimal marker 2.
 - b. Tap (POS=) key.

Complete the Timed Drill, and give the completed job to your instructor.

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PERCENTAGE — INCREASE AND DECREASE

Overview

Per cent means "on or by the hundred." It is a convenient method of expressing the fractional relationships of numbers. In business, it is used extensively to express the increases or decreases of sales, expenses, profits, costs, and manufacturing productivity of one fiscal period over another.

Procedure

Problems 1 - 15:

1. Clear the machine, and set up decimal markers:
 - a. Keyboard — between rows 5 and 4.
 - b. Register dials — between 9 and 8.
 - c. Counter dials — between 5 and 4.
 - d. On Friden multiplier keyboard — over 4.
 - e. On Marchant Deci-Magic, depress decimal key 4.
2. Change the per cent to a decimal by moving the decimal point two places to the left and dropping the per cent sign (%). In Problem 1, 5% is changed to .05.
3. If the per cent is expressed in fractions, change the fractions to their decimal equivalents. In Problem 2, $4\frac{1}{2}\%$ is changed to .045; in Problem 3, $1\frac{1}{4}\%$ is changed to .0025. Problem 1 is now one of multiplication of decimals over a set of fixed decimal places — $475.90 \times .05$.
4. Depress the keys for the amount 475.90 on the keyboard.
5. Shift the carriage to the proper position to multiply by .05, and follow the procedures in Job No. 29 for multiplication of decimals. (On Marchant fully automatics, depress tab 4, and set the directional control to the left.)
6. The answer, 23.79500000, will appear on the register dials. Record it as 23.80 in the spaces provided.

Problems 16 - 30:

1. Clear the machine and set up the same decimal markers used for Problems 1 - 15.
2. On Monroe and Marchant fully automatic calculators, depress tab key 5; on Fridens, tab key 4.

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JOB No. 32 (Cont'd.)

3. Shift the carriage or tabulate so that the decimal marker on the register dials is over that of the keyboard.
4. Depress the keys for **This Year** sales, 2,389.12, and operate the crank or the plus (+) bar.
5. Depress the keys for **Last Year** sales, 2,135.15, and:
 - a. On hand-operated models:
 - (1) Latch down the repeat key, and subtract.
 - (2) Record the amount of the increase, 253.97, which appears in the register dials. **Do not** clear any dials.
 - (3) Move the carriage, if necessary, so that the 2 of 253.97 in the register dials is over the 2 of 2,135.15 on the keyboard, and divide.
 - (4) Record in the spaces provided the answer .1189 that appears in the counter dials, as 11.89%.
 - b. On semi-automatic calculators, follow the same procedure as for the hand-operated models except use the minus (—) bar or (SHORT CUT) bar to subtract, and the division (÷) key instead of a crank. On the Friden, you move the (ADD) key to the **up** position instead of latching down a repeat key.
 - c. On the fully automatic Monroe:
 - (1) Move the carriage so that the decimal marker on the register dials is over that of the keyboard.
 - (2) Index the **This Year** figure, 2,389.12, and depress the plus (+) bar.
 - (3) Index the **Last Year** figure, 2,135.15, and latch down the repeat key, and subtract.
 - (4) Record the increase, 253.97.
 - (5) Move the (DIVD ALIGN) lever away from you or shift the carriage; divide.
 - d. On the fully automatic Marchant:
 - (1) Move the carriage so that the decimal marker on the register dials is over that of the keyboard.
 - (2) Index the **This Year** figure, 2,389.12, and depress the plus (+) bar.

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JOB No. 32 (Cont'd.)

- (3) Index the **Last Year** figure, 2,135.15, and simultaneously depress the (NEG ×) and multiplier key 1.
- (4) Record the increase, 253.97.
- (5) Depress both the (LINEUP) and the (÷) keys.
- e. On the Marchant Deci-Magic:
 - (1) Enter **This Year** sales, 2,389.12, around decimal key 4, and tap the plus (+) bar.
 - (2) Enter **Last Year** sales, 2,135.15, around decimal key 4, and depress (KB LOCK) key.
 - (3) Depress the minus (—) bar.
 - (4) Record the amount of increase, 253.97.
 - (5) Depress the (÷) and (LINEUP) keys.
 - (6) Record the answer, 11.89%, and depress all clearance keys.
- f. On the fully automatic Friden:
 - (1) Move the carriage so that the decimal marker on the register dials is over that of the keyboard.
 - (2) Index the **This Year** figure, 2,389.12, and depress the plus (+) bar.
 - (3) Move the (ADD) key **up**.
 - (4) Index the **Last Year** figure, 2,135.15, and depress the minus (—) bar.
 - (5) Record the increase, 253.97.
 - (6) Depress both division keys.

PROBLEMS 31 - 45:

1. Clear the machine, and set up decimal markers and tabs as for Problems 1 - 30.
2. Shift the carriage or tabulate so that the decimal marker on the register dials is over that of the keyboard.
3. Depress the keys for **This Year** expenses, 1,458.10, and **subtract** by operating the crank or the minus (—) bar.
4. Depress the keys for **Last Year** expenses, 1,579.75, and:
 - a. On hand-operated models:
 - (1) Latch down the repeat key, and **add**.
 - (2) Record the amount of decrease, 121.65.

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JOB No. 32 (Cont'd.)

- (3) Index the **Last Year** expense figure, 1,579.75 and depress (R) Key and plus (+) bar.
- (4) Record the decrease, 121.65.
- (5) Move the (DIVD ALIGN) lever away from you or shift the carriage, and divide.
- d. On the fully automatic Marchant:
 - (1) Move the carriage so that the decimal marker on the register dials is over that of the keyboard.
 - (2) Index the **This Year** figure, 1,458.10, and depress the minus (-) bar.
 - (3) Index the **Last Year** figure, 1,579.75, and depress multiplier key 1.
 - (4) Record the decrease, 121.65.
 - (5) Depress both the (LINE UP) and the division (÷) keys together.
- e. On the Marchant Deci-Magic:
 - (1) Enter the **This Year** expense figure, 1,458.10, around decimal key 4, and tap the minus (-) bar.
 - (2) Enter the **Last Year** expense figure, 1,579.75, around decimal key 4 and depress (KB LOCK).
 - (3) Depress the plus (+) bar.
 - (4) Record the amount of decrease, 121.65.
 - (5) Depress the division (÷) and (LINEUP) keys.
 - (6) Record the answer, 7.7%, and tap (KB CLEAR).
- f. On the fully automatic Friden:
 - (1) Move the carriage so that the decimal marker on the register dials is over that of the keyboard.
 - (2) Index the **This Year** figure, 1,458.10, and depress the minus (-) bar.
 - (3) Move the (ADD) key up.
 - (4) Index the **Last Year** figure, 1,579.75, and depress the plus (+) bar.
 - (5) Record the decrease, 121.65.
 - (6) Depress both division (÷) keys.

Complete the Timed Drill, and give the completed job to your instructor.

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ACCUMULATIVE MULTIPLICATION

Overview

Accumulative multiplication enables an operator to multiply several items of an invoice or an inventory sheet individually and to accumulate the products in the register dials so that the machine multiplies and adds in one operation.

Procedure

1. Clear the machine, and set up decimal markers:
 - a. Keyboard — between rows 5 and 4.
 - b. Register dials — between 9 and 8.
 - c. Counter dials — between 5 and 4.
 - d. Friden multiplier keyboard — over 4.
 - e. On Marchant Deci-Magic, depress decimal key 4.
 - f. Enter all amounts around these fixed decimals.
2. On hand-operated and semi-automatic calculators:
 - a. For Problem 1, depress the keys for 33.652 on the keyboard.
 - b. Multiply by 21.5025 from right to left.
 - c. Shift the carriage to the extreme left, clear the keyboard and counter dials, but **do not clear** the register dials.
 - d. Depress the keys for 45.633 on the keyboard.
 - e. Multiply by 16.6105 from right to left.
 - f. Shift the carriage to the extreme left, clear the keyboard and counter dials, but **do not clear** the register dials.
 - g. Follow this procedure until every multiplication has been completed.
 - h. The answer to Problem 1 is 3100.73756190. Record it as 3100.73756. (Five decimal places is enough.)
 - i. Clear all dials and keyboard, and complete the remaining problems.
3. On fully automatic Monroe calculators:
 - a. For Problem 1, enter 33.652 on the keyboard and depress the (SET UP) or (ENTER MULTIPLIER) key.
 - b. Enter 21.5025 on the keyboard, and depress the (ACC MULT) key.

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JOB No. 33 (Cont'd.)

- c. Clear the counter dials and keyboard.
 - d. Follow this procedure until every multiplication has been completed.
 - e. Clear the machine, and complete the remaining problems.
4. On fully automatic Marchant calculators:
- a. Depress tab 6, because there are two whole numbers in Problem 1.
 - b. Set the directional control to the left.
 - c. Enter 33.652 and depress the (TAB) or (CARRIAGE RETURN) key to position the carriage.
 - d. Depress multiplier keys 2-1-5-0-2-5.
 - e. Depress (TAB) or (CARRIAGE RETURN), keyboard, and (UPPER DIAL) clear keys.
 - f. Follow this procedure until every multiplication has been completed, then clear all dials and complete the remaining problems. Be sure to change the tab setting as the number of whole numbers in the multiplier changes.
5. On Marchant Deci-Magics:
- a. Enter 33.562 around decimal key 4, and tap (X) bar.
 - b. Enter 21.5025 around decimal key 4, and tap (POS=) key.
 - c. Depress (MD LOCK) key.
 - d. Follow this procedure until every multiplication has been completed, then clear all dials, and complete the remaining problems.
6. On fully automatic Fridens:
- a. Enter 33.652 on the keyboard.
 - b. Enter 21.5025 on the multiplier keyboard and depress the (ACCUM MULT) bar.
 - c. Follow this procedure until every multiplication has been completed, then clear all dials and complete the remaining problems.
7. Check the accuracy of the invoice items in Problems 3, 4, and 5 by using accumulative multiplication. Check each extension and the addition separately. Cross out any incorrect figures, and neatly write the correct ones to the right of the printed amounts.
8. Complete the Timed Drill, and give the completed job to your instructor.

(84)



CHAIN DISCOUNTS

Overview

In this job, you will learn two methods of handling chain discounts. Chain discounts consist of a series of trade discounts which may be deducted from the list value of merchandise one by one or in a group by the use of chain discount equivalents.

Procedure

Problems 1 - 5:

1. Clear the machine, and set decimal markers thus:
 - a. Keyboard — between rows 5 and 4.
 - b. Register dials — between 9 and 8.
 - c. Counter dials — between 5 and 4.
 - d. Friden multiplier keyboard — over 4.
 - e. On the Marchant Deci-Magic, depress decimal key 4.
2. Depress the keys for the amount in Problem 1, 370.15, around the fixed decimal on the keyboard.
3. Mentally deduct the first discount, 15%, from 100% to get the per cent equivalent of the net amount — 85%.
4. Change 85% to .85, and multiply as usual over the fixed decimal points. At this point, the register dial shows 314.62750000 and the counter dials, .8500.
5. Clear the keyboard, and depress the keys for the first net amount, 314.6275, around the fixed decimal point on the keyboard.
6. Clear the register and counter dials, and multiply by the second per cent equivalent of the **net** amount, 100% - 10% equals .90. The register dials now read 283.164750000 and the counter dials .90.
7. Clear the keyboard, and depress the keys for the second net amount, 283.1648, on the keyboard.
8. Clear the register and counter dials, and multiply by the third per cent equivalent of the **net** amount, 100% - 5% equals .95. The register dial now reads 269.00656000.
9. Record the answer as 269.01 in the space provided.

(85)

JOB No. 34 (Cont'd.)

10. Remember, on the Monroe fully automatic calculator, use the (SET UP) or (ENTER MULTIPLIER) key and the (MULT CLEAR) key to multiply. On the Marchant fully automatic calculator, depress tab 4, tabulate to position the carriage, and then multiply as usual.
11. Complete Problems 2 through 5 in the above manner.

Problems 6 - 10:

1. Clear the machine, and set decimal markers as follows:
 - a. Keyboard — between rows 6 and 5.
 - b. Register dials — between 11 and 10.
 - c. Counter dials — between 6 and 5.
 - d. Friden multiplication keyboard — over 5.
 - e. On the Marchant Deci-Magic, depress decimal key 5.
2. In the column headed 15 on the Table of Chain Discount Equivalents (page 85), find the equivalent opposite 10-5 in the left-hand column. This is .72675—decimal equivalent of the **net** amount.
3. Depress the keys for the amount, 43.25, on the keyboard around the fixed decimal point.
4. Multiply by .72675, the decimal equivalent of the net amount, over the fixed decimal point as usual.
5. The answer, 31.4319375000, should be recorded as 31.43 in the spaces provided.
6. Remember, on the Monroe fully automatic calculator, use the (SET UP) or (ENTER MULTIPLIER) key and the (MULT CLEAR) key to multiply. On the Marchant fully automatic, depress tab 5, tabulate to position the carriage, and then multiply as usual.
7. Complete Problems 7 through 10 in the above manner.

Complete the Timed Drill, and give the completed job to your instructor.

(86)



REVIEW

This job requires the application of all the operating principles presented in Job Nos. 21 - 34.

Procedure

1. Write your name and other information required in the spaces provided at the upper center of this job sheet.
2. Record, in the spaces provided, the time the job was started, the time it was completed, the number of minutes required to complete it, and the GROSS DIGITS PER MINUTE.
3. To compute the GDPM, locate the last number you worked on during the timed review. To find the number of digits you used, locate the nearest small figures (digital count) above the number you used last. Count the number of digits you depressed beyond this point. Add the number to the digital count. Divide the total by the number of minutes it took to do as much as you were able to do in the testing period. You may use the reverse of this page to do your figuring.
4. Clear the machine, position the carriage, and set up decimal markers as follows for Problems 11 - 20, 24 - 35.
 - a. Keyboard — between rows 5 and 4.
 - b. Register dials — between 9 and 8.
 - c. Counter dials — between 5 and 4.
 - d. Friden multiplier keyboard — over 4.
 - e. On the Marchant Deci-Magic, depress decimal key 4.
5. Write the answer to the problems in the spaces provided below or beside the problems and in the Answers column.

(Page 88 not required.)

(87)

36

TOUCH ADDITION ASCENTS AND DESCENTS OF ONE

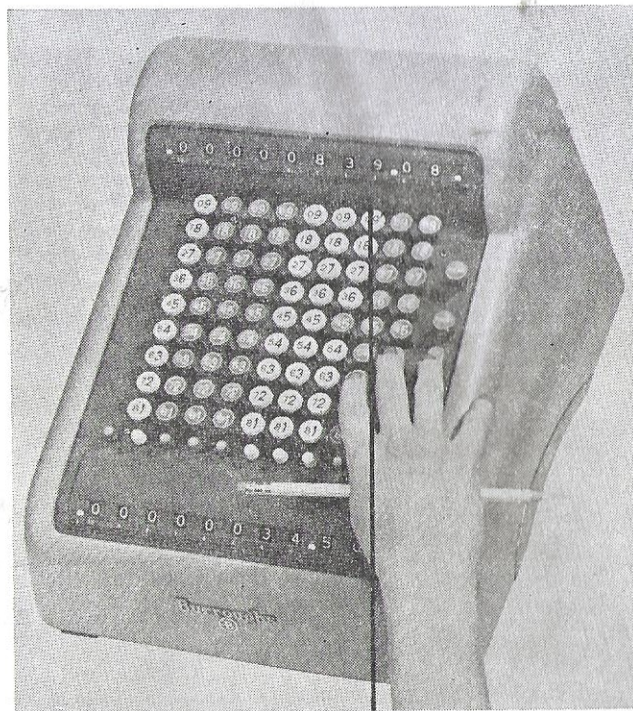
Overview

Office machines that are classified as **key-driven calculators** are the Burroughs calculator, the **Comptometer**, and the **Plus** calculator. While not exactly alike, these machines are so similar that a person trained on one can easily operate the others.

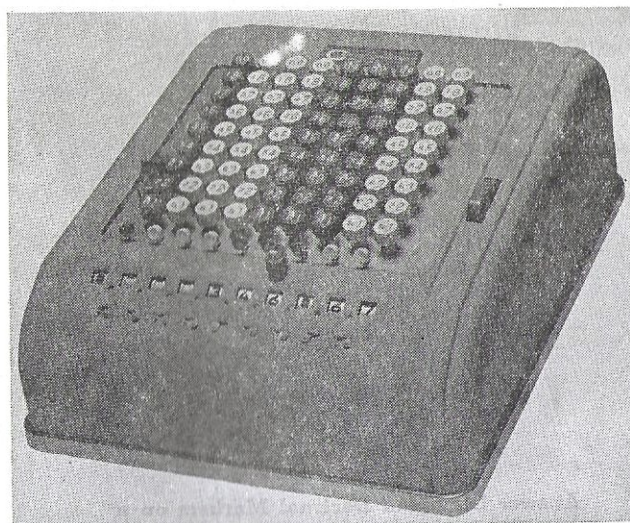
Key-driven calculators can be readily identified by the following characteristics:

1. Keyboards with from 5 to 13 rows or **banks** of keys each of which begins with 1 at the end nearest the operator and ascends to 9 (to 5 on some **Plus** models) at the opposite end. Contrasting colors are used to single out columns used for tens, hundreds, and thousands.
2. Each key has two numbers printed on it. The large numbers are used in all processes; the small ones are used in subtraction and division. To facilitate touch addition, the even-numbered keys are flat while the odd-numbered ones are concave.

KEY-DRIVEN CALCULATOR



Correct Position at the Machine



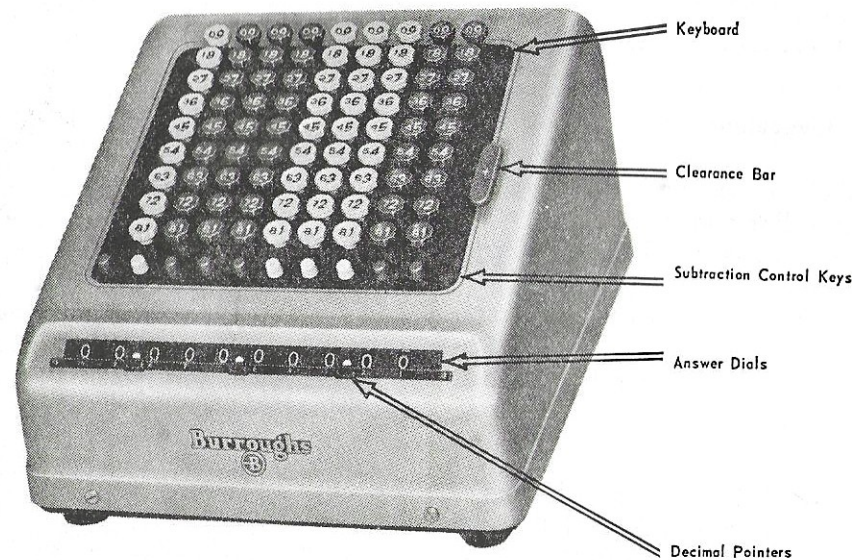
Comptometer Key Driven Calculator

3. Modern key-driven calculators are of three kinds: hand-operated, simplex electrical, and duplex electrical.
4. The answers for all calculations appear in register dials where numbers that are depressed on the keyboard are accumulated until the computation is completed. Hand-operated and simplex electrical calculators have only one set of dials, located under the keyboard. Duplex calculators have two sets of dials — one above the keyboard which is used as a memory unit and one below the keyboard which performs the same functions as the dials on the simplex models. The Plus-O-Matic has a third set of dials which is used in multiplications involving constants.
5. Cancellation levers or bars, decimal markers, cut-off keys, correction keys, full cent keys, touch control keys, and direct subtraction keys complete the list of devices found on modern key-driven calculators.

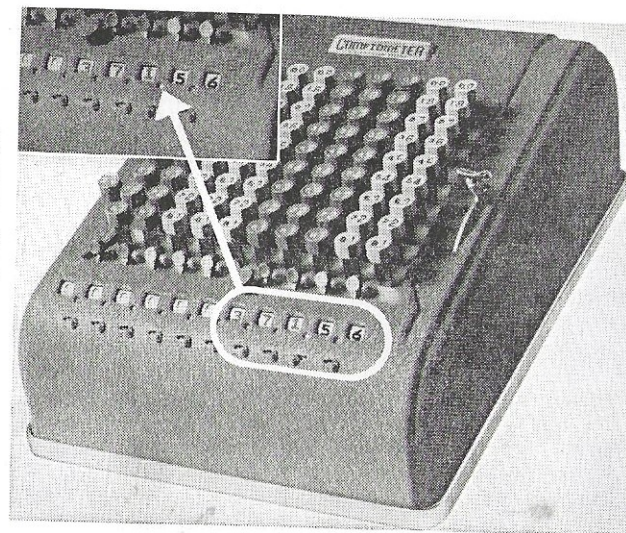
The key-driven calculator is used in business to perform all the fundamental arithmetical processes. Addition, however, is the most widely used of all the arithmetical processes. Therefore, the development of speed and accuracy in **touch addition** is one of the prime objectives of this part of the book.

General Directions

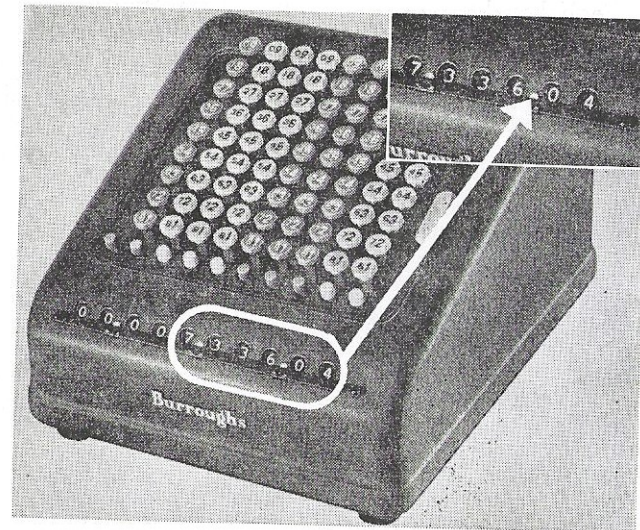
1. Clear your desk or table of books and papers that do not pertain to this course.
2. Position your machine at a slight angle at the right of your desk or table.
3. Place this book at the left of the machine so that the book and the machine form a "V."
4. Position both book and machine to give you ease of reading and writing.
5. Place your pencil between the thumb and the palm of your right hand with the point away from the machine.
6. Sit in a comfortable, erect position with both feet flat on the floor. Study the arrangement of materials and posture of the operator in the illustrations in this job.
7. Clear the machine.
 - a. On hand-operated calculators, use the first and/or second fingers to draw the clearance lever (located at the right of the keyboard) forward as far as it will go. Then release it quickly to allow it to return to its normal position by its own force.
 - b. On simplex electrical models, use the first and/or second fingers to depress the clearance bar located at the right of the keyboard, or draw lever upward on Plus calculator.
 - c. On duplex electrical calculators, depress both the rear and front clearance bars. On the Plus calculator, move the clearance lever



The Operating Parts of a Burroughs Simplex Calculator



Answer Dials and Decimal Markers on a Comptometer



Answer Dials and Decimal Markers on a Burroughs Calculator

(located at the lower right side of the keyboard)
downward to clear lower dials and upward to
clear both lower and upper dials.

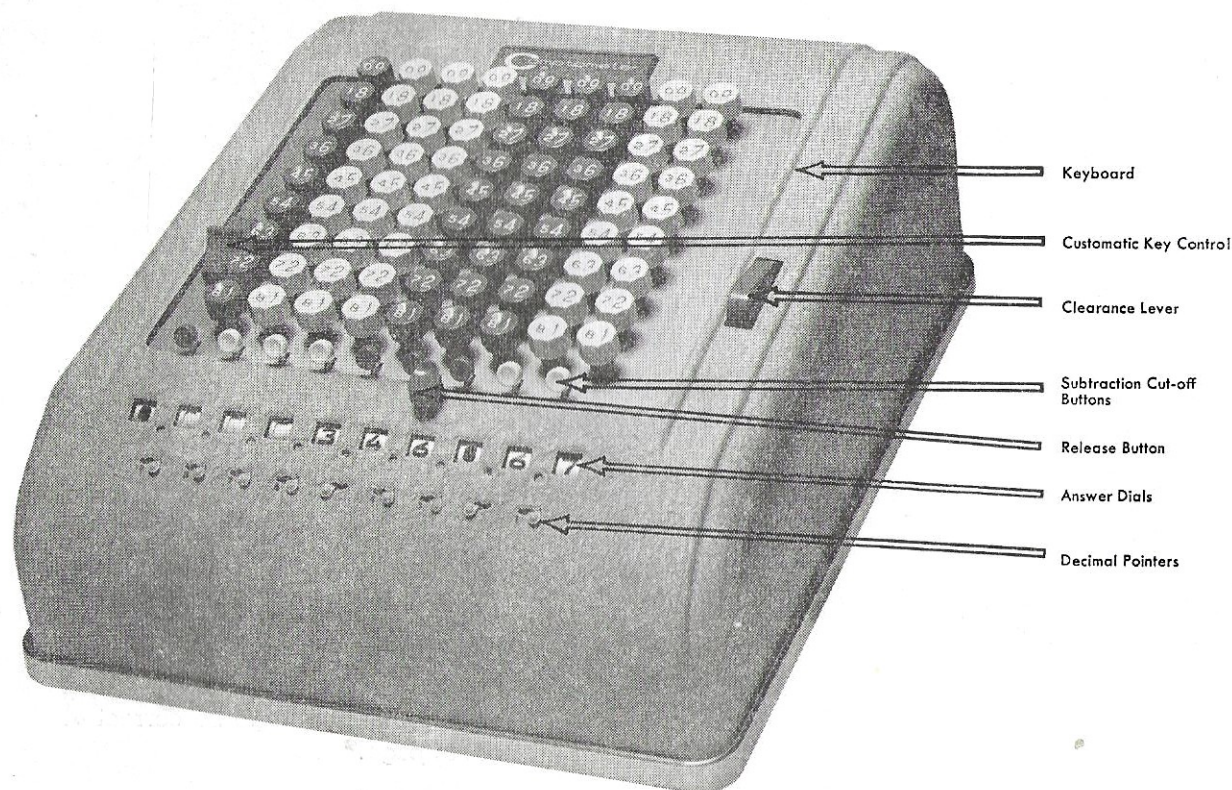
8. Use the touch method to depress the keys for the figures in each number.

a. Hold the pencil between the thumb and the palm of the hand with the point toward the right of the machine.

b. Position the right arm over the keyboard as in free-arm writing with the wrist straight. Curve the fingers as in typing.

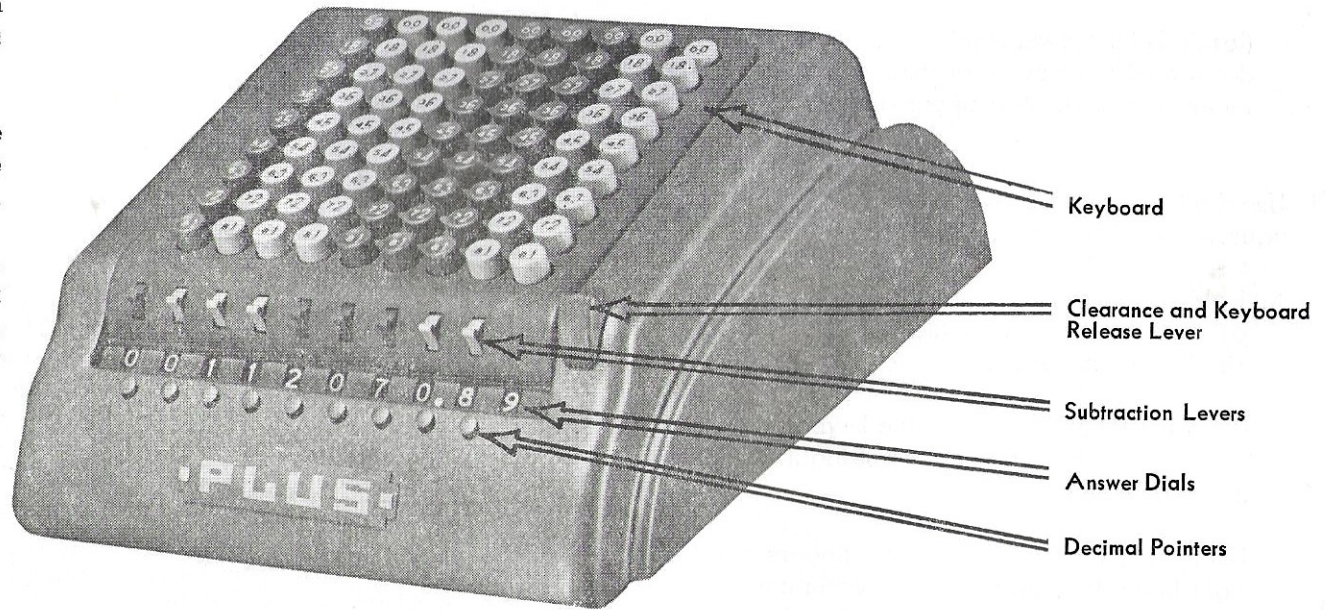
c. Using only the first and second fingers of the right hand, feel the tops of the odd-numbered keys and those of the even-numbered keys at the right side of the machine. Become familiar with the distance between keys so that you can locate and depress them without looking at your fingers.

(1) Strike the keys 1 to 5 in the column at the extreme right with the second finger and those in the second column from the right with the first finger. Be sure to depress the keys fully with a bounce touch and without pausing between strokes.



Operating Parts of a Comptometer Customatic Calculator

- (2) Depress the keys for the figures in each number in the same order in which you would write them.
- (3) **Do not look at your fingers**; feel for the keys. Remember, odd-numbered keys are deep; even-numbered keys are flat-topped.
- (4) Do not use any form of guide, such as a ruler, a blotter, or the fingers of the left hand, to assist in following the figures in a problem. **Train your eyes to follow down the column unaided.**
- (5) If you make a mistake or lose your place, clear the machine and start the problem again.



Operating Parts of a Plus Calculator

9. Develop speed and accuracy in recording answers by:

- a. Forming the habit of making a clear image of the answer in your mind just before clearing the dials.
- b. Writing the answer quickly and clearly under the problem.
- c. Immediately doing the problem a second time, adding in the opposite direction from the first time.

- (1) If the second answer is the same as the first, write it in the proper space at the right of the page.
- (2) If the second answer is different than the first, write it directly below the first answer, and do the problem again. Write the answer that proves to be correct at right of the page.

10. When all problems of the job have been completed and the answers verified:

- a. Remove the job from the book.
- b. If you have not already done so, write your name and the other information called for in the spaces provided at top of the first page of the job.
- c. Give the completed job to your instructor.

JOB No. 36 (Cont'd.)

Procedure

1. Clear the machine. Draw the clearance lever forward, or depress the clear bars. All dials must register 0's before any problem is started.
2. Place a decimal marker between columns 3 and 2.
3. Add the numbers in Problem 1, starting at the top and working down the column, as follows:
 - a. Place the tip of the first finger on the 3 key of the second column from the right, and with a quick, firm stroke depress the key fully, releasing it immediately.
 - b. Place the tip of the second finger on the 3 key of the first column at the extreme right, and with a quick, firm stroke depress it fully, releasing it immediately.
 - c. **Do not depress both keys at once.** In touch addition, keys are depressed separately in the order in which they are read.
 - d. Add the remaining numbers, reaching up for 4's and 5's and down for 2's and 1's.
 - e. Use the touch method — feel for the keys, **do not look at your fingers.**
 - f. Keep up a continuous, bouncing rhythm as you add. **Do not hesitate between strokes.**
 - g. Work at near maximum speed from the beginning. Speed in touch addition is of prime importance.
4. Look in the dials for the answer to Problem 1, make a mental note of it, clear the dials, and quickly and clearly record the answer in the space provided below the problem.

5. Immediately do the problem a second time, beginning at the bottom and adding upward.
 - a. If the second answer is the same as the first, write it in the space provided at the right of the page.
 - b. If the second answer is different from the first, write it directly below the first answer, and do the problem again. Write the answer that proves correct at the right of the page.
6. Follow the same procedure for the remaining problems. If you are operating a Comptometer or a Plus calculator, the machine will lock when you fail to depress a key fully. When this happens go back to the key you depressed before the machine locked, and depress it **all the way**. Unlock the keyboard by depressing the correction key, and continue the adding, starting with the key that locked and signaled the error.
7. Complete the Timed Drill. To compute your GROSS STROKES PER MINUTE:
 - a. Set an interval timer or use the classroom clock to time yourself for five minutes.
 - b. To determine how many strokes you used, first locate the nearest small figures (stroke count) above the last number you added.
 - c. Count the number of strokes you used beyond this point, and add them to the stroke count.
 - d. Divide the total by 5, and record your GSPM in the space provided at the top of the page.
8. Give the completed job to your instructor.



TOUCH ADDITION — TWO-KEY ASCENTS AND DESCENTS

Overview

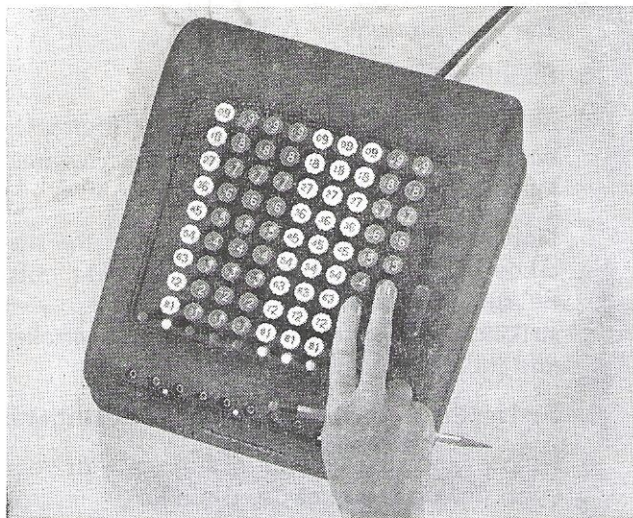
The problems in this job provide additional practice in touch addition of two-digit numbers with one-key ascents and descents. They also introduce touch addition of two-digit numbers with **two-key** ascents and descents.

Procedure

1. Place the text and the machine in the proper position, and assume the correct posture.
2. Clear the machine. All dials must register zeros before any problem is started.
3. **Using the touch method**, add the numbers in each problem, being careful to:
 - a. Hold a pencil correctly in the right hand.
 - b. Hold the right arm as in free-arm writing, with the wrist straight.
 - c. Slightly curve the fingers.
 - d. Strike the keys separately for the figures in each number, using a bouncy and rhythmic touch. Be sure to depress each key fully.
 - e. Make a mental note of the "feel" of the distance between two-key ascents and descents. Be sure to strike the center of each key — striking the outer edge leads to partial strokes and incorrect answers.
 - f. Feel for the keys; **do not look at your fingers**.
 - g. Follow down the column of figures with your eyes, unaided; do not use a guide.

JOB No. 37 (Cont'd.)

4. Develop speed in recording answers by:
 - a. Making a mental note of the answer.
 - b. Clearing the dials.
 - c. Writing the answer quickly and clearly in the space provided under each problem.
5. Immediately do the problem a second time, beginning at the bottom and adding upward.
 - a. Try to increase your speed the second time you do the problem.
 - b. If the answer is the same as the first, write it in the space provided at the right of the page.
 - c. If the second answer is different from the first, write it directly below the first answer, and do the problem again. Write the answer that proves correct at the right of the page.
6. Follow this procedure to complete the remaining problems.
7. Complete the Timed Drill, and compute your GSPM. See page 94 for procedure.
8. Give the completed job to your instructor.



Depressing Keys for .34

(96)

38

TOUCH ADDITION OF 6's, 7's, 8's, 9's, and 0's

Overview

Touch addition on a key-driven calculator restricts an operator to the use of five keys – the 1 to 5 keys only. It would be impractical, if not impossible, to use a touch system that required an operator to "feel" his way up to 9 and down to 1 without looking at the fingers. To avoid ascents and descents in excess of four rows, the following combinations of keys are used for figures above 5:

To add 6, depress 3 twice in column one.
To add 60, depress 3 twice in column two.
To add 600, depress 3 twice in column three.
To add 6000, depress 3 twice in column four.

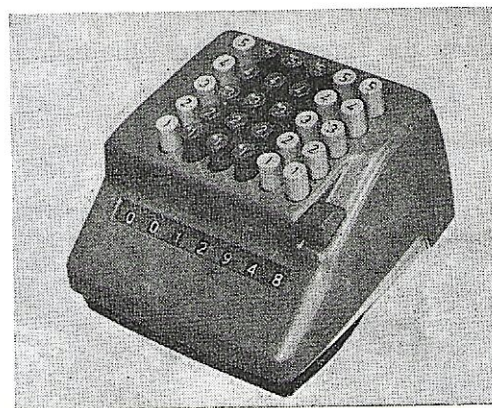
To add 7, 70, 700, or 7000, depress 4 and 3 in the proper columns as described above.

To add 8, 80, 800, 8000, depress 4 twice in the proper columns.

To add 9, 90, 900, 9000, depress 5 and 4 in the proper columns.

Plus manufactures an "Adder" that has keys only for 1 – 5, that portion of a key-driven calculator keyboard that is used in touch addition.

The Plus "Adder"



(97)

JOB No. 38 (Cont'd.)

Zeros in addition are entered automatically by not depressing any keys in the columns in which they occur.

Procedure

The problems in this job involve the use of the combinations of two 3's for 6, a 4 and 3 for 7, two 4's for 8, and a 5 and 4 for 9.

1. Clear the machine, and set a decimal marker between the second and third dials (from the right).
2. Using the touch method, depress the keys for the numbers in each problem, being careful to:
 - a. Depress each key **separately** and with a bouncy and rhythmic touch. Be sure to depress each key fully.
 - b. Not depress any keys for zeros.
 - c. Keep eyes on the book. Keep your place with your eyes; do not use a guide.
 - d. Do each problem twice; add downward the first time and upward the second time.
 - e. Record the answers quickly, legibly, and accurately in the spaces provided.
3. Complete the Timed Drill as per the instructions for Job No. 36, page 94.
4. Give the completed job to your instructor.



TOUCH ADDITION OF THREE-DIGIT NUMBERS

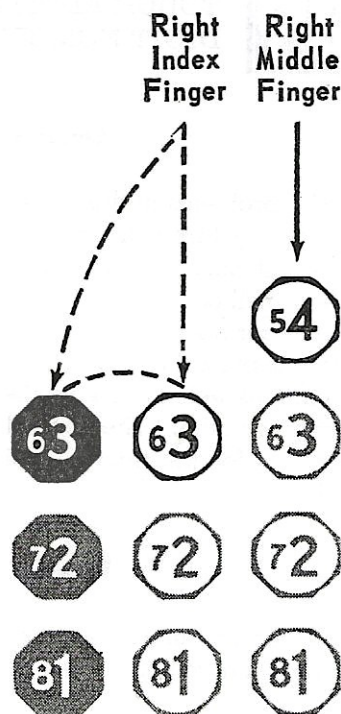
Overview

- The problems in this job are made up of numbers containing three digits. Three-digit numbers, like two-digit ones, are added into the machine by the touch method. In adding three-digit numbers, the first finger does double duty. It reaches across to the left to depress the keys for the figures in the "dollars" column as well as striking the keys for figures in the "tens" column. The second finger depresses only the keys for the figures in the first column (at the right).

Procedure

1. Clear the machine, and set a decimal marker between columns three and two.
2. Place the first and second fingers over the keys of columns two and one at the right for the corresponding digits in the item to be added.
3. With the first finger, reach over one column to the left and strike the key for the first figure on the left of the number.
 - a. Be sure to strike the center of the key; striking the side might result in a partial stroke.
 - b. Do not look at your fingers; "feel" your way across.
4. Strike the key for the second figure in column two with the same finger (the first).

Fingering for
Depressing Keys
for 3.34.



5. Strike the key for the last figure in column one **with the second finger.**
6. Do each problem twice; add downward the first time and upward the second time.
7. Record the answers quickly, legibly, and accurately in the spaces provided.
8. Complete the Timed Drill as for previous jobs.
9. Give the completed job to your instructor.

40

MULTIPLICATION

Overview

Multiplication makes use of all the keys. If the multiplicand contains a 9, you **use the 9 key** not 5 and 4. If it contains an 8, you **use the 8 key** not 4 twice, etc. In multiplication, you look at your fingers **only** to "set" them on the keys for the number to be multiplied. The rest of the process — depressing the keys and moving over one column to the left — is by the touch method. It is recommended that both hands be used even if the multiplicand contains two digits only. Multiplication is accomplished by **repeated addition.**

Procedure

To complete Problem 1:

1. Clear the machine.
2. **Look** while you place the tip of the first finger of the left hand over the 4 key of the second row of keys and the tip of the first finger of the right hand over the 8 key of the first row of keys.
3. Check your posture to see that your fingers are curved slightly, elbows off the desk, wrists flat, and arms extended.
4. Turn your eyes **away from the keyboard and back** to the multiplier.
5. Strike the keys, simultaneously and rhythmically, three times as indicated by the figure at the **right of the multiplier.** Raise the fingers slightly after each depression.
6. **Slide** both fingers over one column to the left. **Do not look** at your fingers as you move them. The first finger of the left hand is now on 4 of the third column, and the first finger of the right hand is on 8 of the second column.

JOB No. 40 (Cont'd.)

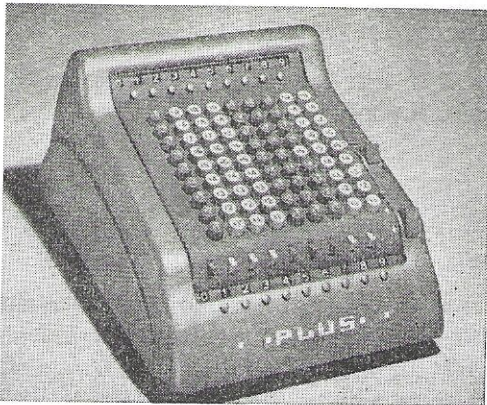
7. Strike the keys, simultaneously and rhythmically, twice for the second figure (from the right) of the multiplier.
8. Record the answer, 1104, in the space provided, and immediately do the problem again. Record the answer that proves correct in the Answer column at the right.
9. Use the same procedure through Problem 22. Be sure to keep your eyes on the multiplier while you strike the keys.

To complete Problem 23:

1. Count the number of decimal places in the multiplier and add them to the number of decimal places in the multiplicand. In Problem 23, there are two in the multiplier, .24, and two in the multiplicand, .85, which makes four to be pointed off in the answer.
2. Move a decimal marker between dials 5 and 4, and multiply as indicated above for problems without decimals.
3. Work other problems containing decimals in the same manner.

Complete the Timed Drill, following the procedure used in the previous jobs.

Give the completed job to your instructor.



A Plus Duplex Calculator

(102)

41

TOUCH ADDITION—THREE-KEY ASCENTS AND DESCENTS

Overview

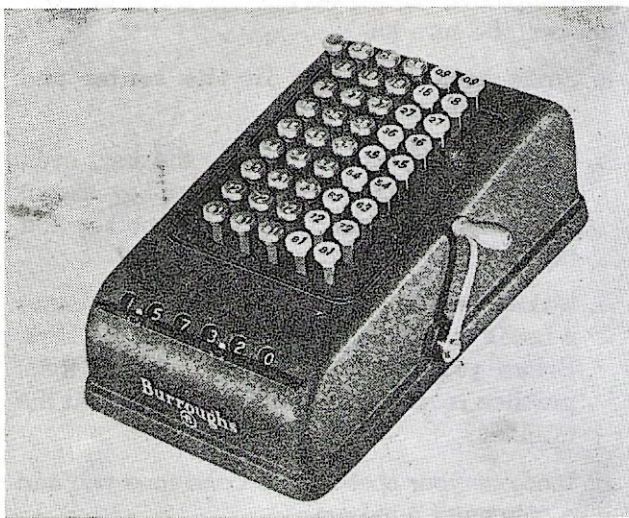
The touch method used in the previous jobs is further developed in this job. You are to "feel" your way up and down between keys for figures which are three keys apart. This will involve reaching **up** from 1 to 4 and from 2 to 5. It will also involve reaching **down** from 5 to 2 and from 4 to 1.

Procedure

1. Clear the machine.
2. Use the touch method to add first **downward** and then **upward** to prove the accuracy of your answer. Be sure to:
 - a. Strike each key firmly **in the center** and release it quickly.
 - b. Reach directly up or down to the key, even though this may involve a three-key ascent or descent. **Do not** "climb" up one key at a time.
 - c. Make a mental note of any reaches that cause a break in the rhythmical striking of the keys. Before you add the column a second time, practice reaching to the keys that caused the trouble.
 - d. Increase your speed the second time you add a column of numbers.
3. Complete the Timed Drill. While it is important to observe all previous instructions, your accuracy and speed in this particular timed drill will be improved by strict adherence to the following:
 - a. Proper placement of the text at the left of the machine.

(103)

- b. Positioning machine to the right at a slight angle.
 - c. Proper posture — feet flat on the floor, arm extended as in free-arm writing, wrist straight.
 - d. Striking each key rhythmically in the center and releasing quickly.
 - e. Keeping your eyes on the text, **not** on your fingers.
 - f. Recording the answers quickly, accurately, and legibly.
4. Give the completed job to your instructor.



A Burroughs 5-Column Calculator

42

SUBTRACTION

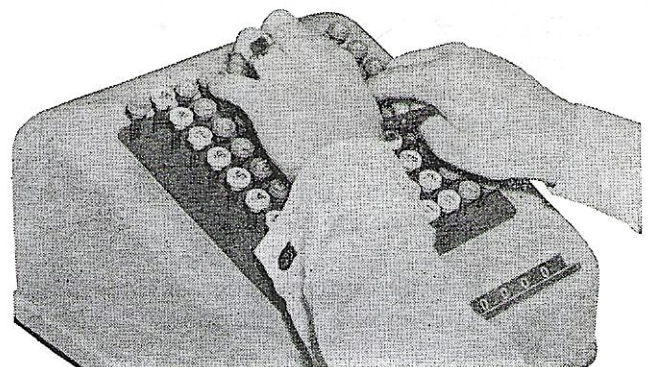
Overview

Each key on a calculator keyboard has two figures printed on it—a **large** one and a **small** one. The large figures are used in adding and multiplying. The small ones are used in subtracting and dividing. The large figures begin with 1 at the **bottom** of the keyboard and ascend to 9. There are no large zeros. In adding and multiplying, columns in which zeros occur are **skipped**. The small figures begin with zero at the **top** of the keyboard and descend in consecutive order to 8 at the bottom. There are no small 9's. In subtracting and dividing, columns in which 9's occur are **skipped**. The small figures are the machine complements of the large figures.

Subtraction on the key-driven calculator is accomplished by adding the complement of the subtrahend (the bottom number). To add the complement of a number, an operator depresses the keys for the **small figures less one** for that number. To complete the operation, he then depresses a series of 9's or subtraction cut-offs to the left of the columns in which the small figures were depressed.

Procedure

To subtract on calculators that do not have subtraction cut-offs (the hand-operated Burroughs):



Subtracting on a Key-Driven Calculator

JOB No. 42 (Cont'd.)

1. Add the minuend (the top number), using the touch method to depress the **large** figures.
2. Add the complement of the subtrahend (the bottom number) by depressing the **small figures less one** for the subtrahend. Do **not** use a touch method to depress small figures. To strike small 6, look for and depress the key with the small 6 and the large 3 (⁶3). To strike small 7, look for and depress the key with the small 7 and the large 2 (⁷2). To strike small 8, look for and depress the key with the small 8 and the large 1 (⁸1).
3. Depress, with the left hand, four 9's (two 9's and the extra blank key on the five-column machines) to the left of the columns used for the subtrahend.
4. Leave the answer in the dials so that you can prove its accuracy by adding the subtrahend using the **large figures** and the touch method.
5. To complete Problem 1:
 - a. Clear the dials.
 - b. Add the minuend, 7.35, using **large figures** and the touch method.
 - c. Depress the keys for the subtrahend **less one**:
 - (1) Look for and depress **small 2** in column three at the right of the keyboard.
 - (2) Look for and depress **small 0** in column two at the right of the keyboard.
 - (3) Look for and depress **small 7** (8 less 1) in column one at the right of the keyboard.
 - d. Depress, with the left hand, the 9's in columns four, five, six, and seven (from the right of the keyboard). On five-column machines, depress the 9's in columns four and five and the extra blank key at the left.
 - e. Copy the answer, 5.27, in the space provided, but do not clear the dials.
 - f. Add the subtrahend, 2.08, to the answer, using **large figures** and the touch method. The dials should show 7.35, the minuend, proving the accuracy of the answer.

JOB No. 42 (Cont'd.)

- g. Write the verified answer in the column at the right.

To subtract on calculators that have subtraction cut-off or control keys (the Plus, Comptometer, and electrically operated Burroughs):

1. Add the minuend, 7.35, using **large figures** and the touch method.
2. Operate the subtraction cut-off or control key:
 - a. Use the first finger of the left hand to hold back the subtraction cut-off between the fourth and third columns of keys on the hand-operated Comptometer.
 - b. Use the first finger of the left hand to hold down the subtraction cut-off between the fourth and third columns of keys on the hand-operated Plus.
 - c. Use the first finger of the left hand to depress the subtraction control key under column four on the electrically driven Burroughs and between columns three and four on the electrically driven Comptometer and Plus.
3. Depress the keys for the subtrahend, 2.08, using the small figures less 1. On the hand-operated models, be sure to hold back the subtraction cut-offs as you simultaneously depress the small figures less one.
4. Verify the accuracy of the answer, 5.27, by adding the subtrahend to the answer, as described above for machines without subtraction cut-off keys.

To subtract on the Plus and Burroughs duplex key-driven calculators:

1. Use the touch method and the **large figures** to add the minuend, 7.35.
2. Transfer the minuend to the rear dials by depressing the plus (+) bar on the Burroughs or by pushing the add-subtract lever downward on the Plus.

JOB No. 42 (Cont'd.)

3. Use the touch method and the large figures to depress the subtrahend, 2.08 (**not less one** and skip column two because large zeros are not depressed).
4. Push the subtract (—) bar **upward** on the Burroughs or the add-subtract lever **upward** on the Plus.
5. The answer, 5.27, will appear in the rear dials.

Complete the Timed Drill, and give the completed job to your instructor.



TOUCH ADDITION — LONGER REACHES

Overview

The touch method of addition limits an operator to the use of five keys—1 to 5. To use the touch method effectively, one must acquire the ability to reach up and down for the keys for 1 to 5 **without looking at the fingers**. The development of speed and accuracy in touch addition is the most valuable competency an operator can acquire. Without it, one cannot develop a marketable skill in the operation of key-driven calculators. To develop speed and accuracy in touch addition, an operator must acquire the "feel" for four "reaches" between keys. These are ascents and descents of one, two, three, and four keys. Two-key and three-key ascents and descents were presented in previous jobs. Four-key ascents and descents are introduced in this job.

Procedure

The development of speed and accuracy in touch addition is dependent upon the formation of good operating habits. Proper positioning of the machine and text contribute as much to your success as do good posture and rhythmical touch. A change in posture results in a change in the "feel" of the distance between reaches, which in turn affects the accuracy of the stroking. To acquire good stroking techniques, you must practice from the same posture, at the same desk height, and with intense concentration for many class sessions. You must constantly check your "reaches" between strokes to insure full depression of keys. You must gauge the stretch between keys accurately to guide your finger tips to the center of the key you are to depress. Striking the outer edge often results in partial strokes which mean either wrong answers or locking of the key-board.

Two new reaches are introduced in this job. They are the four-key ascents and descents used in striking the keys for 15 and 51. As you practice these reaches, make a mental image of the "feel" of the distance between the exact center of the 1 key and that of the 5. Do each problem twice and try to increase your speed the second time.

Complete the twelve addition problems and then:

1. Complete the Timed Drill as usual.
2. Fill in the information required at the top of the job sheet.
3. Give the completed job to your instructor.



DIVISION

Overview

Division is the process of finding how many times one number, known as the **divisor**, is contained in another number, known as the **dividend**. To accomplish this on a key-driven calculator, one subtracts the **divisor** repeatedly from the dividend. Division, like subtraction, makes use of both the large and the small numbers. Division is performed at the extreme left of the keyboard. The answer, known as the **quotient**, appears at the left side of the dials.

Procedure

To do the simple division problems contained in this job, follow the steps listed below for the solving of Problem 1.

1. Use the touch method to add the **dividend**, 1808, into the machine, starting at the **extreme left** of the keyboard. When this has been done, the dials at the left will read 01808.
2. Place a decimal marker at the right of the dividend and then move it one place to the **left** for each **whole** number in the divisor, 16. The dials will show 018.08.
3. Place the tip of the first finger of the left hand over the **small 1** and the tip of the first finger of the right hand over **small 5** (for the divisor, 16, **less 1**) in the two extreme left columns of keys. Just keep the fingers over the keys, **do not depress** them.
4. Look for the remainder in the dials directly under the columns over which your two fingers are poised, and determine whether it is larger than the divisor. In Problem 1, the remainder is 18 which **is** larger than the divisor 16.
5. Depress simultaneously the keys for small 1 and small 5 **once**, and again look for the remainder in

JOB No. 44 (Cont'd.)

the dials directly in line with your fingers.

6. If the new remainder were smaller than the divisor, you would move your fingers one column to the right. If the new remainder were larger, you would strike the keys again. In Problem 1, the new remainder is 02, which is **smaller** than 16; therefore, move one column to the right. The dials will show 102.08.
7. Look for the remainder in the dials directly in line with your fingers and determine whether you have to depress the keys. The remainder, 20, is larger than the divisor, 16, therefore, depress the keys **once**. The new remainder, 04, is smaller than the divisor, therefore, **move one column to the right**. The dials will show 110.48.
8. Look for the remainder in the dials directly in line with your fingers and determine whether you have to depress the keys. The remainder, 48, is larger than the divisor, 16, therefore, depress the keys once. The new remainder is 32 which is still larger than 16, therefore, strike the keys again. The new remainder 16, is exactly the same, but **not smaller** than the divisor, therefore, strike the keys again. The zeros in the dials to the right of the answer, 113, indicate that the problem is finished.
9. **Multiply the answer, 113, by the divisor, 16, to prove the accuracy of the computation** — you should get 1808, the dividend.
10. After you have finished the division problems, do the Timed Drill and give the completed job to your instructor.

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MULTIPLICATION WITH THREE- AND FOUR-FIGURE COMBINATIONS

Overview

The fingering techniques presented in Job No. 40 are further developed in this job to enable an operator to do problems involving three- and four-figure multiplicands. In handling three-figure multiplicands, the first and second fingers of the right hand are used to hold two of the key factors, and the first finger of the left hand is used to hold the third-key factor. Multiplicands containing four-figures are held by the first and second fingers of both hands.

There are four fingering techniques used in heavy multiplication. These are the **natural**, the **inverted**, the **interposed**, and the **cross hand** fingering techniques. The first two will be used in solving the problems in this job.

Procedure

To do problems involving three-figure combinations, follow the steps listed below for solving Problem 1.

1. **Look** while you place the tip of the first finger of the left hand on 5 in column three (from the right) and the tips of the first and second fingers of the right hand on 3 and 5 in columns two and one.
2. Check your posture to see that your fingers are curved slightly, elbows off the desk, and wrist flat.
3. Turn your eyes **away from the keyboard and back** to the multiplier.
4. Strike the keys, simultaneously and rhythmically, six times as indicated by the figure **at the right of the multiplier**, 656. Raise the fingers slightly after each depression.

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5. Slide the fingers over one column to the left. **Do not look at your fingers** as you move them.
6. Strike the keys five times for the second figure in the multiplier, and again **slide** the fingers over one column to the left. **Do not take your eyes off the printed multiplier.**
7. Strike the keys six times for the last figure in the multiplier, and record the answer, 350,960, in the space provided.
8. Immediately do the problem again, and record the verified answer in the column at the right.
9. Complete Problems 2-10 in the same manner.

To do the problems involving four-figure combinations in which the first and last figures are higher than the second and third figures, follow the steps listed below for solving Problem 11.

1. Place the first and second fingers of the left hand on 7 and 5 in columns four and three, respectively. Place the first and second fingers of the right hand on 5 and 7 in columns two and one, respectively.
2. Strike the keys simultaneously five times for the figure at the right of the multiplier, 45.
3. Move over one column to the left and strike the keys simultaneously four times.
4. Immediately do the problem again, and record the verified answer, 340,065, in the column at the right.

After you complete all the multiplication problems, do the Timed Drill, as usual, and give the completed job to your instructor.



MULTIPLICATION—INTERPOSED AND CROSS HAND FINGERING

Overview

This job presents the remaining two fingering techniques for heavy multiplication and the procedure to be followed when either the multiplicand or multiplier contains zeros. The new fingering techniques used in this job are the **interposed** and the **cross hand** fingering techniques.

The interposed fingering technique is used when a **high** figure comes between two low ones, or when a **low** figure comes between two **high** ones. Interposing the fingers of one hand between those of the other eliminates awkward hand positions and enables an operator to bridge the gap between keys that are too far apart to be spanned by the fingers of one hand.

The cross hand position is used to avoid inverted hand positions that are too awkward because they compel an operator to raise his elbows too high above the machine.

Procedure

To complete Problems 1-10 of this job, follow the procedure listed below for Problem 1.

1. Place the tips of the first and second fingers of the right hand on 2 and 3 in columns four and two (from the right), respectively.

JOB No. 46 (Cont'd.)

2. **Interpose** the first two fingers of the left hand with those of the right by placing the tips of the first and second fingers on 8 and 6 in columns three and one, respectively.
3. Strike the four keys simultaneously twice for the 2 at the right side of the multiplier, 82.
4. Move one place to the left, and strike the keys eight times.
5. Record the answer, 232,552, and immediately do the problem a second time.
6. Record the verified answer in the Answers column.

To complete Problems 11-20, follow the procedure listed below for solving Problem 11.

1. Place the tips of the first and second fingers of the right hand on 1 and 3 in columns four and three (from the right), respectively.
2. **Cross over** with the left hand to the right side of the keyboard, and place the tips of the second and first fingers on 7 and 5 in columns two and one, respectively.
3. Strike the four keys simultaneously seven times for the figure at the right of the multiplier, 57, and move over one column to the left.
4. Strike the keys five times, and record the answer, 78,375, in the space provided.
5. Immediately do the problem again, and record the verified answer in the column at the right.

To do multiplication problems containing zeros in either the multiplier or the multiplicand:

1. When one or more zeros appear in the multiplier, **move one column to the left** for each zero without striking any keys.
2. When one or more zeros appear in the multiplicand, **skip the column** or columns in which the zeros occur.

After completing the multiplication problems, do the Timed Drill, and give the completed job to your instructor.

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TRIAL-DIVISOR DIVISION

Overview

The complete division cycle is presented in this job. It consists of three steps: (1) equal the trial-divisor, (2) reduce the remainder, and (3) move one column to the right.

Procedure

To complete the division problems in this job, follow the procedure listed below for solving Problem 1.

1. Add the dividend, 1,824, on the left side of the keyboard and point off two places. The dials will now read 018.240000.
2. Place the fingers over small 2 and 3 (for the divisor, 24, **less 1**) in the first two columns at the **extreme left of the keyboard**.
3. Look for the remainder in the dials directly in line with the fingers. The figure within the parentheses, 18, is the remainder. 0 (18) .240000. Because the remainder, 18, is smaller than the divisor, 24, you **do not** have to reduce it.
4. Move your fingers one column to the right.
5. Look for the trial-divisor. It is the figure in the dials immediately to the left of the columns over which the fingers are poised. The trial-divisor is 1.

0 (1) (82) 40000

TRIAL-DIVISOR ——— **COLUMNS BEING USED**

6. Equal the trial-divisor. To do this, count as you strike the keys **once**. **The count is 1**, but the trial-divisor is now 2, 0 (2) 5840000. Since the **count 1**, and the **trial-divisor 2**, are **not equal**, strike again. The count is now 2, but the trial-divisor is 3, 0 (3) 3440000. Because 2 and 3 are not equal, strike again. The count is now 3,

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but the trial-divisor is 4, $\boxed{0 (4) 1040000}$. Since 3 and 4 are **not equal**, strike again. The count is now 4 and the trial-divisor is 4, $\boxed{0 (4) 8640000}$. The first step in the division cycle has been completed because the trial-divisor was **equaled** and should now be ignored.

7. Reduce the remainder, 86. To do this, depress the keys (without counting) until the remainder, 86, becomes smaller than the divisor, 24. After 3 depressions, the remainder will become 14 and because it is smaller than 24, you **move one column to the right**.
8. Begin the division cycle again by equaling the trial-divisor, 1, $\boxed{07 (1) 440000}$. To do this, **strike** the keys and **count** until the **count** and the **trial-divisor** are the **same**. After you have counted up to 2, the trial-divisor will have been equaled, $\boxed{07 (2) 960000}$, and should be ignored.
9. Reduce the remainder, 96, by depressing the keys until it becomes **smaller** than the divisor, 24. After four depressions, the remainder will become zero, and only the answer, $\boxed{(76) .000000}$, will remain in the dials. Record 76 in the space provided for the answer.
10. **Multiply** the answer, 76, by the divisor, 24, to prove the accuracy of the computation. If you get 1,824, the dividend, record the verified answer in the column at the right.
11. Use the above division cycle of **equal, reduce, move** to complete the remaining division problems.
12. Do the Timed Drill and give the completed job to your instructor.

Overview

When it is necessary to accumulate the results of successive multiplications in a problem containing mixed numbers (whole numbers and decimals or fractions), the decimal point is fixed (set) at some point on the keyboard that will allow ample space to the right of it for all decimal accumulations and ample space to the left of it for all whole number accumulations. On an eight to ten-column machine, the decimal is set between the fifth and sixth columns of keys (from the right); on a five-column machine, it is set between the fourth and third columns (from the right). The operator holds one factor over the fixed decimal (usually the price) and moves one place to the left for every whole number **less one** (in the quantity) **before** he depresses the keys for the first figure at the **left** of the multiplier. He then moves one place to the **right** and continues to multiply from **left to right** for the remaining figures of the multiplier. As he continues to accumulate the products of the factors listed in the problem, the machine automatically lists whole numbers and decimals in their proper columns.

Procedure

To complete Problems 1-10 of this job, follow the steps listed below for solving Problem 1.

1. Clear the machine.
2. Place a decimal marker between columns six and five on an eight- to ten-column machine or between four and three on a five-column machine.

JOB No. 48 (Cont'd.)

3. Place (do not depress) the first finger of the left hand over 2 in column six from the right (the whole number or dollars column) and the first and second fingers of the right hand over 4 and 5 in columns five and four respectively (the decimal or cents columns).
4. Move one column to the left for every whole number **less one** in the quantity. Since 36, the quantity, has two whole numbers, move one column to the left and multiply by 3 (the left figure of 36). The dials will read 73.50.
5. Move one column to the **right**, and multiply by 6. The dials will read 88.20. **Do not** clear the dials.
6. Multiply the three remaining pairs of factors in the same way — moving one column to the left for each whole number less one and multiplying from left to right.
 - a. Place your fingers on .93, move one column to the **left**, and multiply by 4 and then by 5. The dials should show 130.05.
 - b. Place your fingers on 1.35, move one column to the **left**, and multiply by 2 and then by 4. The dials should show 162.45.
 - c. Place your fingers on 2.98, move one column to the left, and multiply by 3 and then by 4. The dials should show the accumulated answer 263.77.
 - d. Record the answer in the space provided, and immediately do the problem again.
 - e. Record the verified answer in the column to the right.

After completing the problems, do the Timed Drill, and give the completed job to your instructor.

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SUBTRACTION — 9's AND CREDIT BALANCES

Overview

This job presents the rules that apply to 9's in subtraction and the procedure to be followed to obtain a true credit balance on hand-operated and on electrical simplex and duplex calculators.

Procedure

When 9's appear in the subtrahend, follow the procedure listed below for solving Problem 1.

1. Using the touch method, add the minuend, 7.45, into the machine.
2. Depress **small 1** in column three (from the right), skip column two because there are no small nines, and depress **small 2** (3 less 1) in column one.
3. Using the left hand, depress four 9's, or **hold back** the subtraction cut-off, or depress the subtraction control key to the **left** of the columns used for the subtrahend. Record the answer, 5.52, under the problem, but do not clear the dials.
4. Verify the answer by adding the subtrahend to it. The dials should show the minuend, 7.45.
5. Record the verified answer in the Answers column.

To complete problems in which the subtrahend has fewer digits than the minuend, follow the procedure listed below for solving Problem 2:

1. Add, by the touch method, 8.75.
2. Depress a **small zero** in column three because the digits in the minuend exceed those in the subtrahend by one.
3. **Skip** column 2 because there are no small 9's.
4. Depress **small 3** (4 less 1) in column one.
5. Depress four 9's or operate the subtraction cut-off key or subtraction control key to the left of column three.

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6. Record the answer, 7.81, and verify its accuracy as you did for Problem 1.

If the figure at the right of the subtrahend is 9, as in Problem 3, no special procedure is needed because the 9 becomes 8 after you subtract 1 — merely depress **small** 1-4-8, and complete the subtraction.

Work Problems 3-10 in the above manner.

When the subtrahend is larger than the minuend, follow the procedure outlined below for solving Problem 11:

1. Using the touch method, add the minuend, 2.75.
2. Depress **small** 5 in column three, **small** 5 in column two, and **small** 7 (8 less 1) in column one.
3. Depress four 9's to the left of the columns used for the subtrahend on **all** simplex machines (do not use subtraction cut-offs).
4. The answer dials will show 99999997.17. The series of 9's to the left of 7.17 indicates a negative or credit balance.
5. To obtain the true credit balance:
 - a. Disregard the 9's.
 - b. Deduct 1 from 7.17 — the only figures in the dials that **are not 9's**.
 - c. Depress **small** 7-1-6. All dials should now register zeros, proving the accuracy of the computation thus far.
 - d. **Again** depress **small** 7-1-6. The dials now show the true credit balance, 2.83 Cr.
 - e. Do the problem again, and record the verified answer in the space provided.

Do the Timed Drill and give the completed job to your instructor.

50 REVIEW

The problems in this job require the application of all the operating principles presented in Job Nos. 36 through 49. This job is really a timed test intended to measure the proficiency you have attained after completing the fourteen lessons on the key-driven calculator.

Procedure

1. Clear the machine, and do each problem as quickly and as accurately as you can.
2. Record the answers directly below or beside each problem.
3. In the spaces provided, record the time the job was started, the time it was completed, the number of minutes required to complete the job, and the gross strokes per minute (GSPM).
4. To compute the GSPM, locate the last number of the last problem you worked on during the timed review. Locate the nearest small figures (stroke count) above the number you handled last. If you did not finish the entire job, count the number of strokes you used beyond the stroke count and add it to the stroke count. Divide the total by the number of minutes it took to do as much as you were able to finish in the testing period. You may use the reverse of this page to do your figuring.
5. Give the completed job to your instructor.

(This is the last page.)

